THE INFLUENCE OF DIGITAL DISTRACTION ON COGNITIVE LOAD, ATTENTION CONFLICT AND MEETING PRODUCTIVITY

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DECLARATION

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ABSTRACT

Background

Meetings are important for organisational functioning and the co-ordination of people, tasks and processes, and an everyday reality of organisational life. As mobile communication technology, such as smart phones, tablets and laptops gets smaller and more powerful, these devices have become more pervasive in every aspect of personal and work life.

Increasingly, organisations allow mobile devices to be used during meetings in an effort to be more efficient and save time. However, for a meeting to achieve the desired meeting outcomes, those that participate in the meeting need be actively engaged and focused. It is widely accepted though that mobile communication technology is distracting and can easily draw away one's focus. This begs the question then as to whether employees should in fact be able to use mobile devices in meetings, or not.

Rationale for the research study

Research into the effect of mobile communication technology as a source of digital distraction on meeting performance, given individual differences in cognitive processing, is limited. Moreover, no experimental studies could be found that have investigated these relationships. It is hoped that the results of the present study will address the gap that was identified in the literature, as well as provide a useful practical contribution for organisations. The findings of the present study may further be used to inform organisation policy and practice concerning the use of mobile communication technology in meetings.

Aim of the research study

The aim of the present study was to investigate if the presence of digital distraction in meetings, i.e. the presence of mobile communication technology or mobile devices significantly negatively influences selected cognitive processes (i.e. cognitive load and attention conflict) and ultimately meeting performance (assessed as the time it takes to make a decision; as well as the number and quality of decisions made).

Research design and method

A two-group post-test only, quasi-experimental research method was utilised to investigate the causal effect of the presence of digital distraction on selected aspects of cognitive processing and meeting performance.

For an experiment to be valid, no systematic bias should exist in the comparison groups before the manipulation or intervention, otherwise, one would not be able to deduce that any difference that is observed after the manipulation or intervention was due to the manipulation or intervention. Therefore, to ensure that two equivalent treatment groups were available, individuals were randomly assigned to two meetings. The composition of the two groups was then assessed using the demographic variables that were collected and were not found to be significantly different from one another. The average level concentration performance or attentiveness was also measured and not found to be significantly different. This suggests that the average level of distractibility was the same for the two groups.

Two equivalent meetings were held with only the availability of mobile communication technology being different between the meetings (i.e. mobile devices were present and used during the meeting or not). After the meetings were concluded, respondents were asked to complete an online questionnaire that consisted of closed- and open-ended questions designed to measure the concentration performance, cognitive load and attention conflict constructs. Meeting performance was further evaluated by two independent subject matter experts using a decision-rating scale.

Sampling and sample

As meetings in organisations was the focus, the study targeted employed individuals, a convenient sample of employees were obtained (n=15) that were randomly assigned to one of two participant groups in two separate meetings.

Results

The inferential data analyses revealed that cognitive load and attention conflict were both statistically significantly higher in the meeting in which the use of mobile devices were available and used, compared to the meeting in which mobile devices were not present. Moreover, it was found that meeting performance was lower in the meeting

where mobile communication technology was present. The members of the two meetings made a similar number of decisions, which the independent assessors rated as being of similar quality, however, the group in which mobile communication technology was available took 30 per cent longer (120 versus 90 mins) to come to a similar outcome.

Findings

The results of the present research study suggest that the presence of digital distraction placed significant (additional) demands on the cognitive processing of individuals, who in meetings are required to fulfil cognitive decision-making tasks. As a direct or indirect result, the presence of digital distractions had a marked negative impact on meeting performance and productivity. Based on the findings, it is argued that restricting digital distractions in meetings can greatly reduce the time spent in meetings, while still achieving desired meetings outcomes.

Meetings are essential to effective organisational management and coordination but are also resource intensive with managers spending substantial amounts of their available work time in meetings. Organisations operating in resource constrained environments need to be increasingly efficient in their use of scarce resources and, arguably, time is the most precious resource of all.

Managerial Implications

Based on the findings of the present study, it is recommended that unless mobile communication devices are required to achieve meeting outcomes, managers should declare meetings as technology free zones. Doing so may lead to shorter more productive meetings giving those that often attend meetings more time to attend to other matters.

Keywords

Digital Distraction, Cognitive Load, Attention Conflict, Meeting Productivity

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CHAPTER 1
INTRODUCTION

Managers, supervisors and other employees regularly assemble with a purpose to conduct and/or attend meetings. In a business context, meetings are defined as planned assemblies of three or more people who gather for a purpose that is usually related to any facet of organisational functioning (Boden, 1997; Brenneis, 1991). Meetings are then conducted with a specific decision-making framework and purpose in mind. Typically, meetings are held to share information; make decisions that require input from multiple stakeholders; allocate roles, responsibilities and resources; reach closure on matter(s); and address issues that require co-operation to be resolved. Meetings are, therefore, an important collaborative decision-making mechanism used in organisations to reach specific tangible outputs.

Even though, as suggested above, meetings are deemed to be essential to effective organisational management, they are resource intensive. Bagire et al. (2015) found that managers spent between thirty and eighty percent of their available daily work time in scheduled meetings, while typical employees spent on average six hours per week in meetings and even longer in large corporate organisations. Therefore, given the substantial amount of time expended in meetings that keep key employees away from their primary tasks, organisations need to ensure that meetings conducted are productive, and that quality decisions are made in the shortest time possible (Rogelberg, Shanock, & Scott, 2012).

To ensure that meetings are effective collaborative conversations that achieve the desired outcomes individuals attending a meeting need to be fully engaged, psychologically present, attentive and focused, that is, fully immersed in the meeting. Both effective participation and engagement are necessary factors for meeting performance and successfully achieving the required meeting outcomes or outputs (Gharakhani & Eslami, 2012; Horava, 2008; Mach, 2013; Taneja, Fiore, & Fischer, 2015).

It is, however, argued that in a meeting multiple and competing demands are placed on employees, both from within the meeting and from outside the meeting. These

demands simultaneously and instantaneously require attention, which causes increased distraction, reducing efficient engagement in a meeting. Existing empirical evidence suggests that the presence of distractions in meetings erodes the quality of communication and exchange, which in turn diminishes meeting performance and success (e.g., (Dewan, 2014; Horava, 2008; Mach, 2013; Taneja et al., 2015). Distractions, as mentioned above, come from various sources and in many forms. However, increasingly, distractions are related to the presence and use of mobile communication and computing devices in meetings.

The availability of cheap and readily accessible internet bandwidth, as well as the increasing portability of communication and computing technology has resulted in a situation where mobile communication technology is constantly connected and readily available for use. Mobile communication technology or mobile devices, such as wearable communication technology, smart phones, tablets and laptop computers have, given their usefulness, increasingly become indispensable tools for business. Given the pervasive and wide-spread adoption of mobile communication technology, which is increasingly becoming even more mobile and powerful in terms of processing power, mobile devices have become part of everyday life and is undoubtedly here to stay.

It is not a new phenomenon that participants in a meeting become distracted and/or find their mind wondering to activities and/or thoughts not related to the task or discussion at hand, whereas in the past people would become less focused in a meeting as their minds wandered. Individuals would often begin to what is referred to as doodle, which can be described as scribbling absent-mindedly or making a rough drawing absent-mindedly. However, the compelling and intrusive nature of mobile devices and the fact that they allow one to deal with work tasks that would need to be completed later thus creating the impression that time is being saved, have arguably turned them into a source of active distraction, that is rather than just a way to pass the time when the user becomes bored or less attentive.

As suggested above, the ever-increasing power and portability of mobile communication and computing devices, such as wearable technology, smart phones,

tablets and laptop computers have resulted in a situation where these devices are increasingly brought into and used during meetings. Anecdotally, in some organisations this practice is even encouraged. Several authors have, however, argued that the presence of mobile communication technology in meetings, coupled with high job demands has led to a situation where what was meant to be a useful business tool has become a notable source of distraction and disengagement to such an extent that it is believed to adversely affect meeting performance (for example, Fox, Rosen, & Crawford, 2009; Patterson & Patterson, 2017; Ravizza, Hambrick, & Fenn, 2014).

Mobile communication technology being a notable active distractor in meetings, brings one to the question: Should mobile communication technology be available for use during meetings or not? Despite the obvious relevance and practical applicability of the question, few studies could be found that have investigated whether the presence of digital distraction would negatively affect meeting performance. Specifically, no studies were found that had used a quasi-experimental approach that allowed for causal inferences to be made. The current absence of empirical evidence to support either practice in organisations, therefore, created an opportunity for the present study to address this topical question and potentially make both a theoretical and practical contribution to this field of study.

Problem statement

As suggested above, meetings are important because they facilitate communication and collaboration processes that are required to solve all types and levels of problems or issues within organisations. However, for meetings to be a success, engagement and effective participation are necessary factors in meeting performance (Gharakhani & Eslami, 2012; Horava, 2008; Mach, 2013; Taneja et al., 2015). However, with employees increasingly using mobile devices while in meetings, digital distractions may lead to cognitive (over)load, attention conflict and a resulting loss of concentration and/or attentiveness.

The brain computes all stimuli by means of cognitive processing which includes, but is not limited to, the constructs of concentration performance, cognitive load and attention conflict. The higher the number of stimuli received, the higher the amount of

available cognitive resources is required to process the stimuli, leading to higher cognitive load, and less cognitive processing power to process any additional stimuli. The higher the number of stimuli, the higher the cognitive load. Furthermore, when there is pressure on the available cognitive resources, it leads to attention conflict, i.e. the process of deciding on which stimuli should one concentrate and process first or allocate more processing power to, is in conflict.

It is argued here that the constraints of human cognitive processes, digital distractions (additional stimuli) in meetings may lead to members shifting their attention from the meeting and to the technology, resulting in a situation where they are no longer fully engaged in the discussions being held and so are not able to contribute effectively to decision-making. Such a situation, in turn, may result in poorer quality decisions being made and/or that decisions take unnecessarily long to be made. There are, however, few studies that have investigated the claim that the presence of digital distraction negatively affects meeting performance. The purpose of the present study is to hopefully address this gap in the literature.

The aim of the present study was, therefore, to investigate if the presence of digital distraction, i.e. mobile communication technology in meetings, significantly influences cognitive processing (specifically, cognitive load and attention conflict) and meeting performance (specifically, time to make a decision; and the number and quality of decisions).

Research objectives

To address the aim of the present study, as described above, the following theoretical and empirical research objectives were formulated:

Theoretical objectives

- Define and conceptualise the constructs under investigation, including digital distraction, cognitive load, concentration performance, attention conflict and meeting performance, using available literature;
- Craft evidence-based arguments for causal relationships between the selected constructs; and
- Make a theoretical contribution to the field of study.

Empirical objectives

- Formulate hypotheses for the proposed causal relationships between the selected constructs;
- Select an appropriate and justifiable research design, research approaches and methods to conduct an empirical study that addresses the aim of the study;
- Measure the selected constructs in such a manner so as to ensure the random distribution of bias, i.e. address validity and reliability issue appropriately;
- Collect, clean, collate and analyse data; and
- Interpret the results of the data analyses correctly and make appropriate and justifiable inferences.

It is suggested that once these research objectives have been adequately achieved, the aim of the research study would have been successfully addressed.

Conclusion

To ensure meeting productivity, it is crucial that participants be fully engaged in the conversations and discussions that take place. The digital era has, however, brought mobile communication and computing technology into the meeting space. The pervasive nature of mobile communication technology places greater demands on cognitive processing and level of attentiveness. When digital distractions are present in meetings, it may result in a situation where cognitive demands outstrip cognitive capacity constraints and when this happens, participants are likely to experience cognitive overload and possible loss of focus (attention conflict) in meeting discussions. This may then lead to less and/or poorer decisions being made, which may have an undesirable effect on value creation and organisational performance.

CHAPTER 2
LITERATURE REVIEW

Introduction

As describe in Chapter 1, the aim of the present study was to investigate whether the presence of digital distractions, i.e. the presence of mobile communication technology in meetings would negatively influence cognitive load, attention conflict and meeting performance.

In this chapter, the literature concerning digital distraction and its related cognitive processes, is described and evaluated. First the constructs, the definitions and conceptualisations of the constructs are presented, then the causal relationship between cognitive load, attention conflict and meeting performance are discussed further. The chapter concludes with a proposed integrated conceptual or theoretical model that will be investigated empirically.

Meeting performance

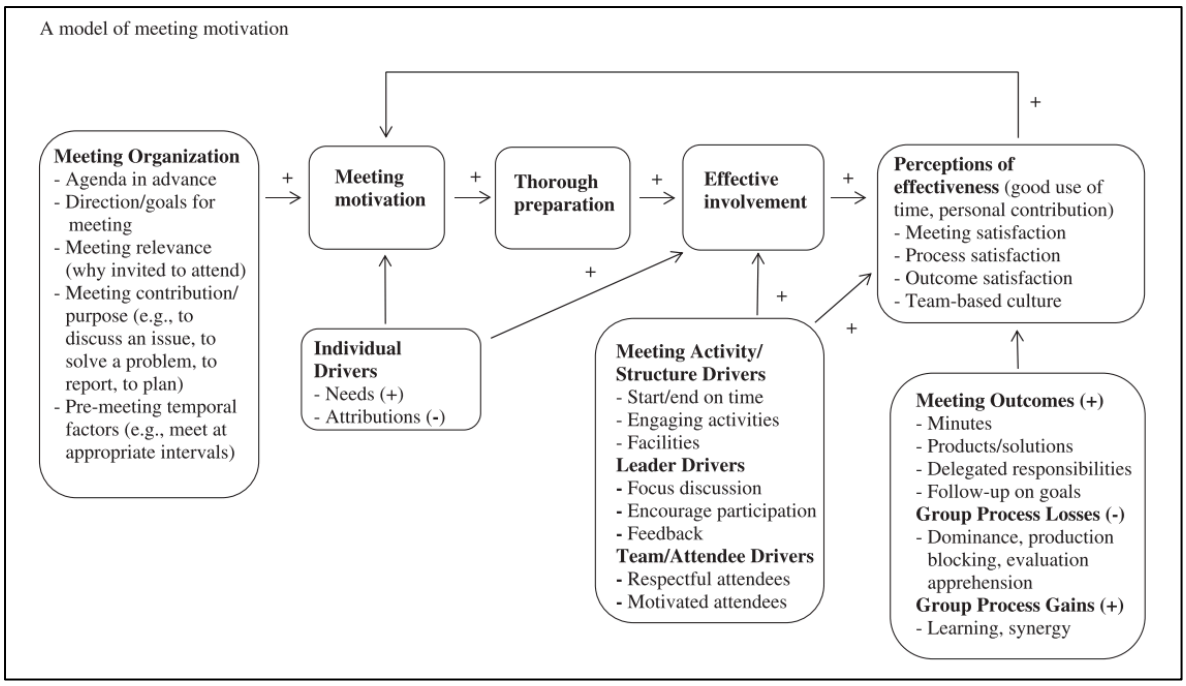
As discussed in Chapter 1, management functions, including planning, organising, commanding, coordinating and controlling are used to direct employee behaviour and performance in such a manner that employees collaboratively contribute to the achievement of strategic objectives and sustained organisational success (Fayol, 2011). To execute the above-mentioned management functions successfully they need to be collaborated and co-ordinated effectively, which usually takes place in the form of a meeting. Successful and effective collaboration, co-ordination and execution is then a function of meeting performance.

Geimer et al. (2015) defines meeting performance as a function of productivity and effectiveness, i.e., the quantity of decisions generated and quality of each decision made, which are the result of the interaction of four core themes, as described below (refer to Figure 1) :

- **Meeting participants**: The participants in meeting have a direct influence on the outcomes of meetings. Participants with higher expertise and better honed meeting skills with a high level of experience and preparedness will positively

influence the productivity of a meeting, with the opposite also being true. Participant involvement in some situations mediates or, as a minimum, partly mediates the consequence of meeting design or management defects. Where the meeting serves the participant's need(s) directly the participant will have improved participation and influence.

- **Meeting organisation**: The organisation, pre-in meeting and post-actions may ensure a productive meeting. A clear agenda circulated before a meeting to allow preparation for it, inclusive of the availability of previous meeting minutes can ensure that participants are prepared for their part in the meeting. Meeting protocols, keeping to starting and ending on time and keeping to content relevance to the said meeting will permit attendees to participate fully and further enhance the effectiveness of the meeting.
- **Meeting activities**: Meeting activities, as discussions, and good leadership by the chairperson, and keeping to the approved agenda items play a big role in the productivity of the meeting. Group progression generates affirmative effects on meeting outcomes and meeting process satisfaction.
- **Meeting outcomes**: A meeting is set to manage one or another operational process, as well as succeeding attitudinal and perceptual outcomes, and therefore decision making is very important, (Geimer et al., (2015). It is not just about making decisions but making sound decisions that are executable in the shortest time possible.



Source: (Geimer et al., 2015, p. 2024)

Figure 1: Meeting motivation model

Similarly, Fetzer (2009) described the requirements needed for productive meetings as, among others, having a clear agenda and purpose; quality minutes of previous meetings; a chairperson skilled in meeting procedures; participants that possess the necessary expertise and experience and that are appropriately briefed and prepared (subject matter experts); clear meeting expectations and etiquette; and, if required, administrative support. Productive meetings are, therefore, a function of the individuals in the meeting, meeting procedures and facilitation by the chairperson.

Nicholson, Nicholson, Parboteeah and Valacich (2009) in their study have surveyed the effect of time pressure on task implementation and found that unassuming tasks took three times longer with high levels of distraction and multifarious tasks 50 per cent longer in the same conditions. Svenson and Edland (1993) noted that "… a time constraint may lead to the experience of time pressure and more intense time pressure may increase the level of arousal and psychological stress" this places pressure on cognitive capacity and heightens cognitive load (Bailey & Konstan, 2006; Bowman, Levine, Waite, & Gendron, 2010).

Nicholson, Nicholson, Parboteeah and Valacich (2009) postulated that meeting productivity was negatively influenced at all levels of distraction, no matter of the level of complexity of the task. Furthermore, Levine, Waite and Bowman (2012) and Bailey and Konstan (2006) suggested that the interruption of task performance by digital distractions resulted in increased time being needed to complete a task, that fewer decisions were made, and decisions were of a lower quality.

Given practical considerations, for the purposes of the present study three dimensions of meeting performance were chosen: 1) the time it took to make a decision (measured in minutes); 2) the number of decisions that were made (frequency of decisions); and 3) the quality of the decisions made (assessed by two subject matter experts (SME) using a decision quality framework discussed below).

Digital distraction

Distraction is the result of any stimulus that diverts an individual's attention away from one task to another. When attention is diverted from a primary task to a secondary task(s) it may lead to the primary task not being completed or not completed as intended (Seemiller, 2017; Xie & Wu, 2018). The new Shorter Oxford English dictionary on historical principles defines distraction as a "…diversion of the mind, attention, etc., from a particular object or course; the fact of having one's attention or concentration disturbed by something" (Brown, 1993, p. 716). While this definition lacks context, it does suggest that distraction involves a diversion of attention away from a primary task and that this diversion interrupts a person's concentration on the primary task at hand (Regan, Hallett, & Gordon, 2011).

In ancient times, distraction may have been the act of writing itself taking one's time away from thinking; followed by reading, blamed by some for society's ills; then the printing press, the radio, television and now computers, all attributers to the era of distraction. The concern is no longer concerned that reading distracts people, but that we are distracted from reading itself (Watanabe-Crockett, 2018).

Furedi (2015) claims that the age of distraction is a myth and that digital devices are not destroying concentration and memory, as widely perceived, and, more specifically, that mobile communication technology should not be blamed for diversion.

Moreover, Furedi (2015) postulates that the era of distraction has been here all along and that the present distractor to blame is mobile communication technology. He concludes that distractions and accusations of attention diminution are not new, but the distractors have changed over the years. He postulates that it is more probable that the current quandary is not the accessibility of exciting powerful new mobile communication technologies, but rather, the insecurity about what to communicate.

On the other hand, Westervelt (2016), in turn, suggests that humans have evolved from being food to information foragers, and that it is not about stressing to find the next meal but rather checking mobile communication technology for the next big update.

Central to survival humans set high-level goals that are accomplished through extreme cognitive control. According to Westervelt (2016), this includes attention, working memory, and goal management.

Westervelt (2016) also postulates that, distraction is the incapability to negate unwanted distractions: the white noise of additional tasks is clouding available concentration from the primary task. Focus on the primary task is dispersed to distractions, leading to a drop in quality. Distraction is the inclination to check mobile communication technology constantly, therefore, performance lags created by switching between tasks lead to overall poor performance.

Both authors agree that distraction, being digital or otherwise, bring about diminished focus on the task at hand which leads to lower performance levels. Westervelt maintains that the biggest current contributor to distraction is mobile communication technology; thus, digital distraction.

It is argued above that the ever-increasing utilisation of mobile communication technology in organisations and its ubiquitous impact on all aspects of work, has led to a situation where digital distraction may have become a significant source of active distraction for people, which has resulted in a reduction of in individual and organisational performance. For the purposes of the present study, digital distraction

is defined as any distraction that is digital, i.e. mobile communication technology that may potentially interfere with a participant's attention on a primary task (Dörner & Edelman, 2015).

Given the aim and purposes of the present study, digital distraction was, therefore, operationally defined as the presence of mobile communication technology during a meeting. The brain has to compute all the input received from the mentioned distractors and in the cognition, process executes priority setting and reaction to each stimulus. This cognitive processing is discussed further below.

Cognitive processing

Rosen (2016) argued that humans were not like parallel processing computers and, therefore, could not simultaneously process different sources of information effectively, nor at the speed computers were able to. Neurologically speaking, cognitive limitations determined an individual's information-processing capabilities and shaped a wide range of behaviours, ranging from quick decision-making to long-term goal searching and self-regulation.

Available cognitive capacity is distributed between concurrent tasks according to the demand required by each individual task (Van Cauwenberge, Schaap, & Van Roy, 2014). Being distracted, for example, by digital distractions or any other sources of distraction for that matter, places additional demands on cognitive processing in terms of both attentiveness and the ability to process information. If the level of the distraction is high enough, that is, surpasses the constraints of the cognitive processes, negative effects on observable performance outcomes are observable.

Several cognitive processes determine an individual's ability to deal with competing demands such as distractions, including the current level of cognitive load and attention conflict. There is a limit to the amount of information the brain can process at any given point in time. Moreover, for an individual to complete a cognitive task effectively and efficiently, the brain needs to pay attention or concentrate on the task, while also completing the necessary processing of the information. Key cognitive processes are, therefore, relevant to the research question and include concentration performance, cognitive load, working memory, multi-tasking and attention conflict.

Each of these constructs, as well as how they impact on one another, is discussed in more detail below.

Cognitive load

According to Reedy (2015), “Cognitive load theory seeks to distinguish factors that make the encoding and consolidation of new knowledge more efficient or, conversely, more difficult. Cognitive load theory is particularly helpful when considering how to design tasks and environments.” (Reedy, 2015, p. 356).

Sweller (1988) investigated the cognitive load construct within the context of learning and distinguished between three types of cognitive load Table 1 (see below):

- **Intrinsic load:** The intrinsic load of an environment, problem or task is focused on its intrinsic difficulty for a participant and is inconstantly dependent on a participant’s experience in a specific area. It cannot be lowered, but a task can fit the level of a participant’s expertise level or recent knowledge.
- **Extraneous load**: Extraneous load is related to the new information management or experience design. Weakly developed experiences have a high extraneous load and not ideal for acceptable performance.
- **Germane load:** Germane load is related to the intrinsic load of the task and focus on ensuring the difficulty of the task is suitable, challenging and encourages participant involvement (Van Merriënboer, Kester, & Paas, 2006).

Excessively high cognitive load characteristically results in unproductive participation; therefore, the primary and secondary task is not completed efficiently. The focus of cognitive load theory is to increase intrinsic and germane load such that the task at hand is suitably challenging, whilst keeping unnecessary extraneous load as low as possible, by optimising the setting in which the task is executed (DeLeeuw & Mayer, 2008). Similarly, Sweller (1988) found in his study with learning, that students that experience higher levels of cognitive load, recalled significantly less content than those experiencing lower levels of cognitive load (Puglisi, Leonetti, Cerri, & Borroni, 2018).

Table 1:

Types of Cognitive load

Type of cognitive load	Definition	Example[1]
Intrinsic load	The nature of the learning environment, problem, or task has an inherent level of difficulty associated with it.	Making a decision in a meeting is a task that includes many different aspects; participants typically find it difficult to learn and must practise becoming skilled at the task.
Germane load	Part of the inherent difficulty of a learning task is necessary and helpful to the learning process. This is the germane load of a task.	Making a successful decision in a meeting, a participant must also know how to develop solution options. It is part of the process and therefore a required part of the task.
Extraneous load	Learning tasks can be made more difficult by the way they are structured, presented, or designed or by the nature of the learning environment.	Making a decision in a meeting can be made much more difficult by any number of factors: if the process or the goal is not explained clearly or the steps involved are not fully articulated, or if a participant has to participate in a loud and busy setting.

Note: [1]Examples adapted for the present study (Reedy, 2015, p. 358)

Cognitive load is further related to the availability of attentional, cognitive resources such as working memory. To further support the cognitive load, this supporting concept will be described, thereby furthering an understanding of cognitive load as a construct in the present study.

Working memory

Ward, Duke, Gneezy and Bos (2017) and Engle and Kane (2003) suggested that working memory refers to complex cognition supported by the cognitive reasoning system by dynamically selecting, maintaining and processing information that is relevant to the current tasks and goals. Furthermore, working memory capacity reflects attentional resource availability. Working memory is inhibited by the actual available attentional resources, similar to the Random-Access Memory (RAM) of a computer. Available working memory is, therefore, limited by the cognitive load that multiple task processing places on the available concentration capacity and thus is directly related to the level of cognitive load that is experienced when multiple stimuli compete for the available cognitive capacity. The additional stimuli referred to above are further related to multi-tasking, the number of stimuli that the limited cognitive processing can handle.

This necessitate a discussion of multi-tasking as a supportive construct to cognitive load

Multitasking

Multitasking does not have a singular definition. The variant addressed in the present study is the is most applicable in the workplace where people switch between multiple dependent tasks (Dux, Ivanoff, Asplund, & Marois, 2006). Popular media most interested with this form of multitasking with multiple articles on the productivity effects of multitasking. A relevant example of multitasking is when people multitask on a computer, switching back and forth between windows or tabs.

The above-mentioned definition of multitasking is similar to task-switching, with a distinct difference, dependency. Contingent tasks lend to the potential benefits of multitasking, that is, repeating a previous challenge with a new perspective. In contrast, where a person gets a new stimulus to work on each time (e.g., he or receives a new pair of numbers to multiply), the operation remains the same, but not the problem. In this case the type of multitasking refers to reality in the modern work environment where employees switch between several demanding and ongoing tasks.

Moreover, time constraint is a defining characteristic of multitasking. According to Koch, Poljac, Müller, & Kiesel (2018) the term task classically refers to a mental or behavioural goal that is instructed or self-instructed. In addition to twofold tasks that requires co-existence, real-time motor responses, task interruptions, and continuations, as well as serial task switching all fall inside most definitions of multitasking (Adler & Benbunan-Fich, 2012; Junco, 2012; Wu, 2017).

Where multiple tasks compete for available cognitive capacity and working memory, as described above, it was found that higher levels of cognitive load exist. Switching within the available cognitive capacity from one to another task increases cognitive load.

However, engaging in multi-tasking potentially leads to lower levels of concentration performance in the execution of individual tasks and task performance on the whole. Therefore, multitasking is assumed to increase cognitive load and decrease

concentration performance even further. Researchers also argued that true multitasking is a myth and not even possible to achieve, as the human brain can only focus on one task at a time and that the competition for cognitive capacity is rapid task switching rather than multitasking (Berdik, 2018; Koch et al., 2018). Assuming that the above statement that multitasking increases, cognitive load is correct, the brain is continuously challenged to assign attention to each stimulus received, from the primary task at hand or other distractions that now lead to attention conflict.

Attention conflict

Attention has been defined as the "…concentration of the mind upon an object; maximal integration of the higher mental processes" (*Macquarie Dictionary*, 1988, p. 147). It has also been defined as focused mental engagement on a particular item of information (Davenport & Beck, 2001, p. 20) or time spent interacting with someone or something (Simon, 1971, p. 41).

As suggested above, cognitive load is further a mechanism required for completing individual tasks. When competing tasks get to a point where they overload the available cognitive processing capacity, the brain pays attention to each individual task, i.e. one at a time, to process the information. Given the limited cognitive capacity to process information generally though, individuals need to become more selective in their allocation of attentional resources which, in turn, creates attention conflict as the brain tries to focus on the one task while still trying to deal with the others.

Ward et al. (2017) claimed that the priority, in other words, the likelihood of a stimulus attracting cognative attention is determined by both its physical realm and its goal relevance. Related to this, Ward et al. (2017) also argued that automatic attention generally helped individuals make the most of their imperfect cognitive capacity in directing attention to frequently goal-relevant stimuli without requiring these goals to be constantly kept in mind. Automatic attention may sometimes weaken the performance when a stimulus is commonly relevant, but irrelevant to the current task at hand, as it occupies the limited attentional resources.

Distractions, such as background noise or other external stimuli that interfere with concentration, place a further load on constrained cognitive ability, and if at sufficient

levels may lead to more important stimuli being negated or that their priority is downgraded – while unimportant stimuli may become priority and in this way decision-making is impeded (Wilmer, Sherman, & Chein, 2017).

As alluded to above, attention conflict absorbs cognitive capacity and intensifies the probability of cognitive overload and attention conflict, leading a person to narrow his or her focus to those signals that are core to the task at hand or that of the distraction (Groff, Baron, & Moore, 1983; Lawrence, Kinney, & Connell, 2017). The more tasks that are added to the average person, the higher his or her cognitive load and the less cognitive capacity is available to process each new stimulus.

Concentration performance

The ability to concentrate thus focussing mental effort, is a primary function of cognition; a process generally called attention (Michael & Greher, 2000). Inattention, has been defined as the "…failure to pay attention or take notice" (Trumble, Brown, & Stevenson, 2002, p. 1340). Over the course of the past sixty years, information processing theories were developed to explain attention, comparing the mental processing of information to the processing of data by a computer (Broadbent, 1958; Cherry, 1953). Furthermore, another aspect of attention referred to in the literature is a state of arousal, preparedness, or vigilance, that facilitates particular attentiveness (concentrates attention) to a person's environment (Matlin, 1994).

The way in which attention is effectively concentrated on the task at hand can be defined as concentration performance. Concentration performance involves attentive processing (Hillstrom & Chai, 2006) thus processing the environment attentively regarding the task at hand and presumably performing better in the task. The time of day also plays a role in the concentration levels of the individual and has a direct relation with the performance attained. It is better to thus schedule high focus, concentration tasks when an individual's mind is generally fresh, which is called the attentive hours (Yeo & Quek, 2012). Concentration performance is likewise closely related to mindfulness, where mindfulness refers to an awareness of, and attentiveness to, the present moment (Dane, 2011) or more practically stated, attentiveness to the current work activity. (Wilmer et al., 2017). This level of

concentration or attention is required to complete the task at hand, at the performance levels required.

Concentration performance has an influence on cognitive processing and is inertly related to cognitive load. However, a higher cognitive load could potentially curtail concentration performance. For the present study it is, therefore, important to discuss the cognitive load construct to later affirm the relationship between the constructs.

Summary of the theoretical argument

Based on the literature review presented above, it is argued that the level of meeting performance is determined by concentration performance, cognitive load and level of attention conflict. It is further suggested here that digital distraction, defined as the presence of mobile communication technology, places an additional demand on cognitive processes required to fulfil cognitive decision-making tasks, which are required to conduct a productive meeting, i.e. making enough, good decisions in the shortest possible time.

The argument or logic underpinning the present study, is further summarised as follows:

The presence of mobile communication technology, in other words, digital distractions in meetings lead to lower levels of meeting performance, because of:

- **the constrained nature of cognitive capacity**, i.e. digital distractions place an additional demand on cognitive processing capacity that leads to an increase in cognitive load experienced;
- **the competing demand for attention**, i.e. digital distractions demand attention, over and above the attention required to deal with the cognitive tasks at hand, which leads to higher levels of attention conflict; and
- **the level of concentration performance**, i.e. higher levels of distractibility or attention deficits are related to lower levels of concentration performance. Moreover, given the interaction between concentration performance and level of distraction, there is a positive relationship between distraction, cognitive load and attention conflict, which are inversely related to concentration performance; in other words, where there are lower levels of concentration performance (or

higher distractibility of attention deficits) and higher levels of distraction, one would more likely have higher levels of cognitive load and attention conflict that results in poorer performance on cognitive tasks.

Integrated theoretical/conceptual model under investigation and hypotheses

Based on the arguments presented above the following theoretical/conceptual model, graphically represented in Figure 2 (see below), is proposed and was further investigated to find empirical evidence or support for it.

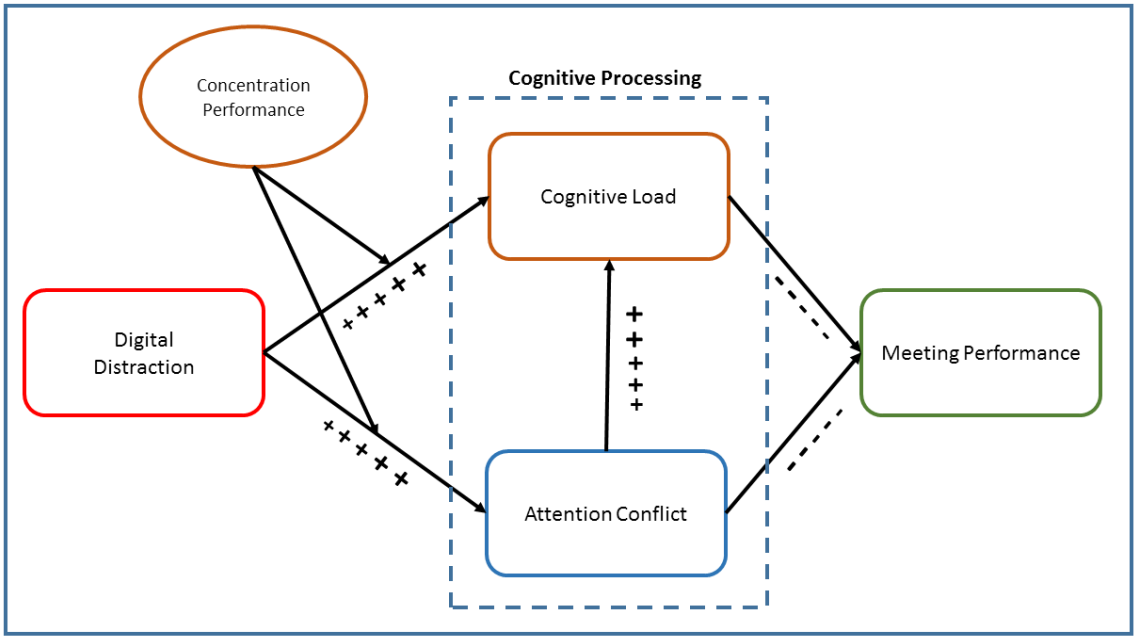


Figure 2: Theoretical/conceptual digital distraction model under investigation

Based on the arguments presented above and summarised in the proposed theoretical/conceptual model above, the following hypotheses were formulated:

***Hypothesis 1 (H1)**: Perceived cognitive load will be statistically significantly higher in a meeting where digital distractions (i.e., mobile communication technology) are present, compared with a meeting where mobile communication technology is not present.*

***Hypothesis 2 (H2)**: Perceived attention conflict will be statistically significantly higher in a meeting where digital distractions (i.e., mobile communication*

technology) are present, compared with a meeting where mobile communication technology is not present.

***Hypothesis 3 (H3)**: Meeting performance (including, time to make decisions, decision quality and number of decisions made) will be statistically significantly higher in a meeting where digital distractions (i.e., mobile communication technology) are not present when compared with a meeting where mobile communication technology is present.*

The moderating effect of concentration performance was not investigated here. Rather, concentration performance was measured and used to ensure that the two groups were, on average, not statistically significantly different in respect of this variable to each other. If one group had a statistically significantly higher or lower level of concentration performance compared with the other group, it would mean that the one group is at the onset more or less distractible than the other. Concentration performance would, therefore, be a confounding variable and negate any finding that the groups differ in terms of the other variables under investigation.

Conclusion

In this chapter a brief literature review of digital distraction, attention and focus constraints in cognitive processing was presented. Cognitive load was further described in terms of the related constructs of working memory and multi-tasking, both of which are related to higher cognitive load. Meeting performance was defined and linked to the constructs of time, number of decisions and quality of decisions made.

Based on the arguments that were presented in this chapter, an integrated conceptual or theoretical model was developed. Finally, based on the conceptual or theoretical model, three hypotheses were formulated to be investigated further.

CHAPTER 3
METHOD

Introduction

The methodological approaches utilised in the present study to address the aim of the study are described in this chapter. The research design, data approaches and research procedures, including the measurement tools and sampling approach utilised to collect data are, firstly, set out. Secondly, the methods employed are described. Finally, the realised sample is discussed, followed by a discussion of the ethical and data management considerations that were taken into account in executing the research study.

Research design, approaches and methods

Given the aim of the present study, namely, to investigate causal relationships and make causal inferences about the effect or influence of the independent variables on the dependent variable, an experimental research design was utilised. More specifically, it was decided that a two-group post-test only, quasi-experiment would be appropriate to investigate the influence digital distraction on attention conflict, cognitive load and meeting performance.

Primary qualitative and quantitative data were collected, using both open-ended and close-ended questions, respectivly, that is, a mixed-methods approach to data collection was employed. The research approaches utilised in the present study can further be described as having collected cross-sectional data (i.e., collected at a given point in time, rather than longitidunal data) and of the *ex post facto* variaty (i.e., after the fact).

Sampling and participants

Given cost and time constraints, a non-probable convenient sampling approach was followed. It could also be described as a judgement sample given that even though a convenience sampling approach was followed, a sample was targeted that could be argued would be relevant for the proposed aim and objectives of the present research study.

The Human Resources (HR) department of a mining organisation in South Africa was targeted, given that access to the research site could be gained. Taking sampling considerations into account, the identified research site was deemed to be appropriate for the objectives of the present study.

Fifteen (15) individuals are employed in the mine's HR department and all of them were included in the quasi-experiment. Using randomisation or a random assignment procedure, individuals were randomly assigned to one of two meetings held concurrently.

The sample demographic characteristics of the total sample and split by group are summarised for interval variables in Table 2 and nominal variables in Table 3 (see below).

Realised sample

Table 2:

Sample demographic characteristics by group for interval variables (n = 15)

Characteristic per group	Group 1[1] (n_1 = 8)			Group 2[1] (n_2 = 7)		
	f	Mean	Std dev[2]	f	Mean	Std dev[2]
Age	8	43.8	5.4	7	38.9	8.5
Tenure	8	4.4	3.9	7	4.0	1.6
Economically active	7	13.0	8.3	7	14.0	8.7

Notes: [1]Group 1 = mobile communication technology was available; Group 2 = mobile communication technology was not available.

[2]In samples smaller than 25 a standard deviation needs to be interpreted with caution given the limited variability of the data.

Table 3:

Sample demographic characteristics by group for nominal variables (n = 15)

Characteristic	Subcategory	Group 1[1] (n_1 = 8)		Group 2[1] (n_2 = 7)		Total (n_t = 15)	
		f	Percentage	f	Percentage	f	Percentage
Gender	Female	5	71%	3	38%	8	53%
	Male	2	29%	5	63%	7	47%
	Total	7		8		15	
Race	Black	6	75%	6	86%	12	80%
	White	1	13%	1	14%	2	13%
	Other	0	13%	1	0%	1	7%
	Total	7		8		15	
Highest level of education	High school graduate, diploma or the equivalent	7	88%	2	29%	9	60%
	Bachelor's degree or equivalent	1	13%	4	57%	5	33%
	Honours degree or equivalent	0	0%	1	14%	1	7%
	Total	8		7		15	

Characteristic	Subcategory	Group 1[1] (n_1 = 8)		Group 2[1] (n_2 = 7)		Total (n_t = 15)	
		f	Percentage	f	Percentage	f	Percentage
Occupational Level	Non-managerial/non-supervisory	4	50%	1	14%	5	33%
	Supervisor/Team Leader	4	50%	2	29%	6	40%
	Middle Management	0	0%	3	43%	3	20%
	Senior Management/Executive	0	0%	1	14%	1	7%
	Total	8		7		15	

[1]Group 1 = mobile communication technology was available; Group 2 = mobile communication technology was not available.

Design of the quasi-experiment

Two concurrent meetings of two hours each were held. The meetings were chaired by the same individual and the same agenda was followed, that is, the same matters were discussed and also in the same order in each of the meetings (see Appendix A).

As suggested above, using randomisation or a random assignment procedure, individuals were randomly assigned to one of the two meetings. This was done to ensure, as far as possible, that no systematic bias was present and to ensure the validity of the experiment. Those that were assigned to Group 1 attended a meeting in which digital distractions were present. By contrast, those assigned to Group 2 attended a meeting where digital distractions were not present. They were unaware that the meetings were constituted randomly. The individuals all worked together in the same HR department across two sites (i.e., onsite at the mine and at the offices in the nearby town) and regularly worked with one another in different combinations and at both sites when required to work on various projects across the organisation. The assignment of individuals to one of two meetings was, therefore, not out of the ordinary for them. It was, therefore, argued that the assignment to one of two meetings and the resulting constitution of the meetings did not introduce a confounding variable that may have influenced the outcome measures.

In the meeting with Group 1, the chairperson allowed participants to use their devices while in the meeting. This is more often than not the default approach in the organisation. In the meeting with Group 2, the chairperson asked participants to put away and not use their devices while in the meeting. This was done in such a manner that attention was not specifically drawn to this. Once the meeting and data collection had been concluded, participants in Group 2 were asked if the request had any effect on the way they perceived the meeting process. None of them indicated that it had done so, and it was accepted without question or real thought.

During the meeting with Group 1, a set of typical messages and tasks were electronically mailed (e-mailed) to the participants. These were typical requests and messages that the employees concerned received on a daily basis. This was to ensure that a typical level of digital distraction was experienced and to counter the chance

that for the period during which the meeting was held, no messages were received. These requests and messages included the following:

- **Distractions associated with video conferencing**: One member of the meeting participated virtually in the meeting. During the meeting, the person's Internet connection was interrupted, and the Information and Communications Technology Department (ICT) was called to assist in reconnecting the call;
- **Distractions associated with urgent e-mails**: E-mails were sent requesting important tasks requiring an urgent response from meeting participants;
- **Distractions associated with general administrative e-mails**: An e-mail was sent from one of the senior managers requesting a specific task that was not time critical; and
- **Distractions associated with telephone calls**: One participant, whose mobile telephone was not on silent, was called resulting in the phone ringing during the meeting.

None of the distractions were out of the ordinary for any of the participants, nor were they perceived to be when asked at the end of the experience.

Ensuring the validity of the quasi-experiment

The veracity and utility of the findings of the research study are a direct function of the validity of the experiment conducted. Importantly, given that pre-test scores were not available, the risk that any difference in post-test scores was the result of a confounding varaible(s), such as pre-exsiting systematic differences in the two groups that explain differences in post-test scores (and not the experimental minulation) had to be mitigated. Threats to the internal and external validity of the experiment were, as far as possible, mitigated and are discussed below.

To migate for threats to the internal validity of the experiment:

- the meetings were, as far as it was possible, similar to each other. To achieve this, the same chairperson facilitated both meetings, the meetings had the same planned duration and the same agenda was followed. An observer was further placed in the meeting to observe whether the meetings were for all intents and purposes the same and to point out where they were not.

- the use of mobile communication technology, that is, the presence of digital distraction was the only planned difference between the two meetings. Attention was not drawn to the chairperson's allowance of the use of mobile communication technology, so as not to introduce bias or draw unnecessary attention to the fact that the use of mobile communication technology was being manipulated.

To migate for threats to the external validity of the experiment:

- randomisation, that is, random assignment of participants to the two groups, was utilised to ensure that the groups were, as far as possible, similar in their composition, as to not introduce error or systematic bias;
- in an attempt to compare whether or not the composition of the two groups was different from each other, the demographic variables that were collected where statistically compared across the two groups. The results of these analyses are presented and discussed later in this chapter (see below); and
- the nature of the distractions introduced to the group in which digital distractions were allowed was such that they were not out of the ordinary and did not introduce bias.

As is the case with most social science research, and the present study is no exception, there are always limitations to the study that result from trade-offs that are made. The limitations of the present study, though not uncommon, are aknowledged and discussed further in Chapter 5. As far as possible, these were mitigated for to ensure the validity and reliablity of the results.

Data collection procedure and the measuring instrument

At the conclusion of both meetings, participants were asked to complete an electronic questionnaire (see Appendix B). The questionnaire consisted of closed and open-ended questions that were designed to collect quantitative and qualitative data, respectively.

The questionnaire or measuring instrument consisted of several sections, each including sub-scales used to measure the constructs relevant to the present study. Each of these are described and discussed below.

Meeting performance

Meeting performance, the dependent variable (DV), was measured using the following three criteria:

- Number of decisions taken,
- Time taken to make decisions, and
- Quality of decisions.

The meetings were recorded, which is common practice in the organisation and was therefore not unexpected. After the meetings, the recordings were used to count the number of decisions made in each of the meetings and to ascertain the time taken to make each decision.

To assess the quality of the decisions made, a set of questions adapted from the Patient Education and Counselling, more specifically, the 9-item Shared Decision-making Questionnaire by Kriston Levente, et al. (2010) was used in a subject matter expert review process. An example item was: 'It was made clear that a decision is required'. Items were responded to on a five-point Likert-type response scale, where 1 = Completely disagree and 5 = Completely agree. Satisfactory measurement properties have been found for this scale in previous studies (Kriston et al., 2010).

Two subject matter experts independently reviewed the recordings and assessed the quality of each decision made during the meetings using the Shared Decision-Making Questionnaire and provided their scoring on each dimension. The Mean of the quality scores for each decision awarded by the reviewers were calculated, as well as the overall Mean score per group.

Concentration performance

The Adult Attentional Self-report Scale Checklist (American Psychiatric Association, 2013) was used to measure general concentration performance. This scale was developed by the World Health Organisation (WHO) and is freely available as a screening checklist for the general public. If after completing it a certain cut-off score or above was achieved, it is suggested that the person approach a clinician that can conduct a diagnosis. It is, therefore, not used for diagnosing attention deficit

hyperactivity disorder (ADHD) or clinical use but has been shown to be useful measure to assess a general level of perceived attentiveness.

The sub-scale measures the extent to which participants generally perceive their level of attentivensss or focus and consists of 17 items. An example item was “How often do you have problems remembering appointments or obligations?” Items were responded to on a five-point Likert-type response scale, where “1 = A Great Deal” and “5 = None at all”. Satisfactory measurement properties have been found for this scale in previous studies (American Psychiatric Association, 2013; Barkley, 1998).

Cognitive load

The NASA Task Load Index (NASA-TLX) post-task questionnaire is generally utilised for studying human factors and ergonomics. It contains 6 questions where respondents must answer on a 10-point scale, ranging from 1 = Very Low to 10 = Very High. Each question addresses one dimension of the perceived workload: 1) mental demand, 2) physical demand, 3) time pressure, 4) perceived success with the task, 5) overall effort level, and 6) frustration level (NASA, 2017).

For the purposes of the present study, cognitive load was measured using only one item of the NASA-TLX to which respondents had to indicate their level of agreement on a nine-point Likert-type response-scale. The response scale ranged from “1 = Very, very low mental effort” to “9 = Very, very high mental effort”. For the present study one item was tested, namely perceived mental demand. Participants had to by respond with only one answer on the scale to the following question; “Consider the meeting that was just held. In solving the problems discussed, I invested....” Given the objectives of the present study it was believed to be an appropriate measure of mental demand.

This mental effort measure, as part of the NASA-TLX, was utilised in several research studies in the past where participants were asked to rate the amount of mental demand, physical demand, time pressure, perceived success with the task, overall effort level and frustration level they invested in completing a task that they were given (Young, Zavelina, & Hooper, 2008).

Attention conflict

An adapted version of the Mindful Attention Awareness Scale (Carlson & Warren, 2005; Dam, Earleywine, & Borders, 2010) was used to measure attention conflict. The scale comprises 15 items responded to on a five-point Likert-type response scale, where “1 = A Great Deal” and “5 = None at all”. An example item is “Concentrated for short periods of time”.

Satisfactory measurement properties have been found for this scale in previous studies (Puglisi et al., 2018). Satisfactory internal consistency or scale reliability was demonstrated (Cronbach’s alpha = .92, i.e. >.7).

Perceptions of digital distraction in meetings

Respondents further answered two open-ended questions. Respondents were asked to:

- describe whether they believed employees should be able to access digital devices (e.g., mobile telephones and laptops) during meetings or not, and to provide reasons for their answers; and
- respond to whether or not they were able to make use of digital devices during meetings; and whether or not it affected the productivity of the meeting, that is, the quantity and quality of decisions made during a meeting?

Demographics

The final section of the questionnaire consisted of various demographic questions that were used to: 1) assess whether the participants in the two groups were not systematically different, at least based on the variables collected; and 2) describe the realised sample.

The demographic questions included: age, gender, and race, highest level of education, and occupational level, and tenure both in the company and relevant industry, and the average number and length of meetings that the respondents were typically required to attend.

Assessing group demographic differences before commencing the study

As discussed above, to mitigate for threats to the internal validity of the quasi-experiment, the two groups should not systematically differ from one another before the experimental manipulation and to introduce error or bias in the results. It is argued that, if the two groups were for all intents and purposes the same before the experiment, any difference in the post test can most likely be attributed to the manipulation or experimental condition and not to other confounding variables.

Considering the descriptive statistics summarising the demographic variables of the overall sample, as well as for the two groups (see Tables 2 and 3 above) distinct differences in the composition of the two groups were not apparent. To further assess this observation and find support for the claim that the groups were not systematically different from one another before the experiment, Chi-square and T-test statistics were calculated for the demographic variables that were collected and are reported below.

Non-parametric statistics

A cross-tabulation of the each of the categorical demographic variables, i.e. gender, race, educational level, job level and group membership was calculated and the level of association between them assessed using the Pearson Chi-square statistic (Berendsen, 2011). The results of these analyses are summarised in Table 4 (see below).

Table 4: Association between categorical variables and group membership

	χ^2	df	p-value	Sig p<.01 or <.05
Gender*Grp[1]	.633	1	.426	p>.05.
Race*Grp	.938	2	.626	p>.05
Education Level*Grp	5.536	2	.063	p>.05
Job Level*Grp	6.429	3	.093	p>.05

Note; [1]Grp = Group membership

When the summarised results in Table 4 (see above) were considered, none of the cross-tabulations were found to produce statistically significant Chi-square results (p>.05). The null hypotheses were, therefore, not rejected suggesting that there is no support for any significant associations between the selected categorical demographic

variables and group membership. Based on these results, the categorical demographics variables, i.e. gender, race, educational level and job level were not statistically different from one another when comparing the two groups with each another.

Parametric statistics

T-test statistics were calculated using the continuous demographic variables, i.e. age and tenure in the organisation with group membership as the factor variable to assess whether the groups were statically different in terms of the demographic variables (Berendsen, 2011). The results are summarised in Table 5 (see below).

Table 5: Continuous demographic variables T-tests (n=15)

	Mean Group 1[1] (n=8)	**Mean Group 2[2] (n=7)**	**T**	**df**	**Sig**
Age	43.9	4.9	-1.350	13	p>.05
Tenure	4.4	.38	-.239	13	p>.05

Note: [1]Group 1 = mobile communication technology was available. [2]Group 1 = mobile communication technology was available.

Considering the results summarised in Table 5 (see above), the T-tests comparing the Means of the selected continuous variables for each group, were not found to be statistically significant (p>.05). The null hypotheses could, therefore, not be rejected. Based on these results, the groups when compared on these demographics variables, i.e. age and tenure in the organisation were not statistically different from one another.

Average time spent in meetings

Questions related to general attendance of meetings, specifically how many meetings per week and the average length of meetings the respondents attend. The participants attended between two and five meetings a week that lasted, on average, about 2 hours each. On average, the groups spent 17,5 per cent of their available working hours during a week in meetings, which equates to almost one working day and supports the claim in the introduction that employees spent a lot of time in meetings.

Concentration performance

Attention deficits or higher levels of distractibility are related to lower levels of concentration performance. There is also a positive relationship between distraction, cognitive load and attention conflict, which are inversely related to concentration performance (Yeo & Quek, 2012); in other words, where there are lower levels of concentration performance (or higher distractibility of attention deficits) and higher levels of distraction, one would more likely have higher levels of cognitive load and attention conflict that results in poorer cognitive task performance.

As described above, concentration performance was measured using the 17 item Adult Attentional Self-report Scale checklist (American Psychiatric Association, 2013). Based on the data collected from the sample, the Cronbach alpha coefficient was found to indicate satisfactory reliability or internally consistency (Cronbach alpha = .95, i.e. >.7; Field 2013). Furthermore, as per Field's (2013) recommendation, adequate corrected item-total correlations were also revealed (.97 < r > .39, i.e. >.3). The SPSS Statistics item-analysis procedure also indicated that removing any of the items would not increase the sub-scale's Cronbach alpha coefficient of the sub-scale reported above.

Based on the reliability analysis reported above, the score was believed to be an appropriate measure of the concentration performance construct that could be used in the further inferential statistical analyses.

A composite Mean score for the seventeen (17) items of the sub-scale was then calculated for each participant. The descriptive statistics for the measure of perceived concentration performance, is summarised in Table 6 (see below):

Table 6: Concentration performance descriptive statistics

Groups[1]	n	Min	Max	Mean	Std dev[2]
Group 1	7	5	5	4.9	.822
Group 2	6	4	5	4.5	.754

Notes: [1]Group 1 = mobile communication technology was available; Group 2 = mobile communication technology was not available.

[2]In samples smaller than 25 a standard deviation needs to be interpreted with caution given the limited variability of the data.

From Table 6 (see above) it is evident that Group 1 (i.e. who were allowed to utilise mobile communication technology during the meeting) was found to both have a slightly higher Mean, i.e. on average experienced higher concentration performance; and that the range for concentration performance scores were slightly wider pivoting at 4.9 (compared with Group 2 = 4.5). The descriptive statistics are graphically represented, using a Box-and-Whisker plot (see Figure 3). This would suggest that there was a small numerical difference in perceived concentration performance between the two groups, with higher concentration performance reported for the group in which mobile communication technology were available. However, this is a difference at one decimal point on a 5-point response scale. This result is argued to be negligible.

The box-and-whisker plot for the concentration performance variable, is presented in Figure 3 (see below) and is interpreted as suggested above.

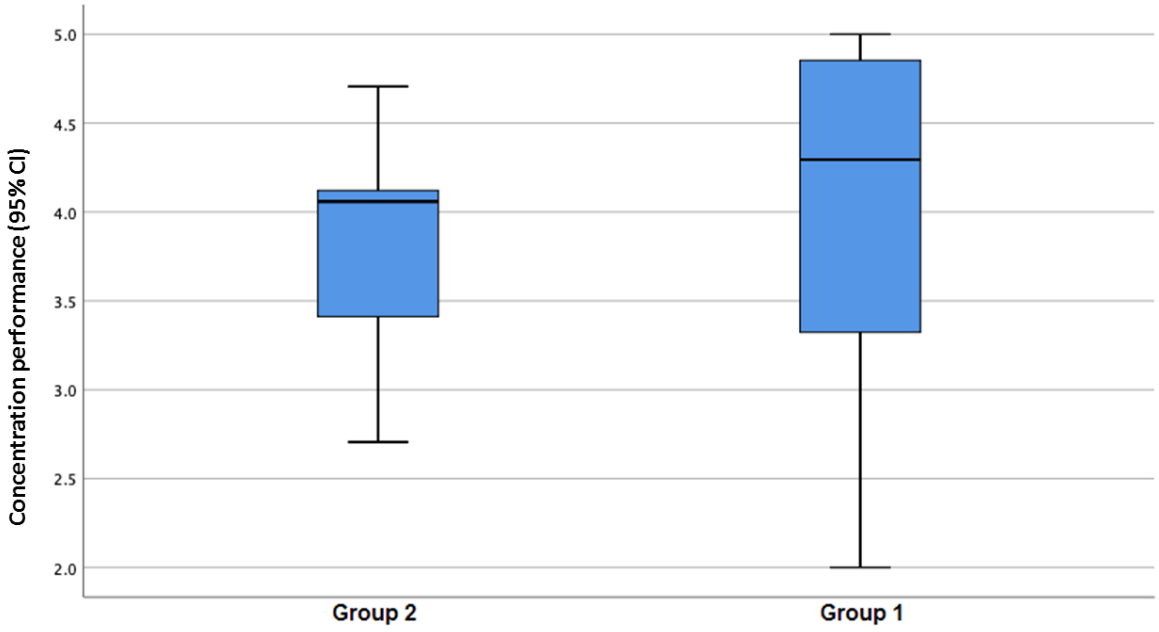


Figure 3: Concentration performance - Box-and-Whisker plot

To assess whether the numerical difference in the Mean scores reported above was also statistically significantly different from one another, a T-test was calculated. The result of the T test indicated that the numerical difference between the Means was not

statistically significantly different (M_{Gp1}= 4.0: M_{Gp2}= 3.8; t=-0.420; df=13; p=.675, i.e. p>.05)

Based on the descriptive and inferential statistics reported above, it is believed that perceived concentration performance was not statistically significantly different in the two groups. This would suggest that a distinct difference in perceived concentration performance or generalised attentiveness was not apparent between the two groups, i.e. that one group was not generally more (or less) distractible or attentive than the other and therefore not more (or less) prone to the effect of distractions.

Summary of group comparison analyses

As discussed above, to mitigate threats to the validity of the experiment, there cannot be systematic differences between the groups at the onset. If the groups were biased and different from each other prior to the experiment, this may have then explained any difference in the dependant variable (meeting performance in this case) rather than being able to attribute the difference to the manipulation (mobile communication technology present or not in this case).

As reported above, none of the demographic variables that was collected and compared for the two groups using parametric and non-parametric statistical analyses was found to be statistically different (see Tables 4 to 6, above).

Based on the basket of evidence presented above, the conclusion was drawn that the two groups were, as far as could be ascertained, believed to not be systematically different to each other and that the quasi-experiment was therefore internally valid.

Ethical considerations

It is noted that researchers face many ethical requirements in meeting professional, institutional standards for research using human participants. For the purposes of the present study, generally accepted ethical guidelines and practices were followed.

In the request to participate in the research study, as stated on the cover page of the questionnaire, participants were given the information required to provide informed consent. This included, stating the objective of the research study, the envisioned use

of the data collected and the contact details of the researchers. Participation in the research study was further described as being voluntary, and it was made clear to the participants that they had an option of whether or not to participate in the research study. The questionnaire was completed anonymously and, therefore, participants were not required to disclose any information that could be used to identify them, nor was any personal identifiers collected or kept anywhere in the questionnaire. Moreover, a debriefing session was offered after the completion of the questionnaire to address any questions the participants might have had. However, no participant took the opportunity to attend the session.

Ethics approval for the current research study was granted by the University of Cape Town (UCT) Commerce Faculty Ethics in Research Committee (EiRC) with no restrictions or reservations. The approval letters from both the EiRC, as well as the organisation (research site) are attached in Appendices C and D respectively.

Data management considerations

UCT's Research Data Management (RDM) Policy underpins legislation related to the principles of managing research data and supports the validation of research results, providing research opportunities in data reuse, and enabling actionable and socially beneficial science to address global research challenges. The research data of the present study was managed, in line with the FAIR open data principles (data should be 'findable, accessible, interoperable and reusable') on an international standard for open data and open science and are uploaded on UCT’s institutional repositories.

Conclusion

In this chapter, the methodical approach applied in this study was described and discussed. The research design, approaches and procedures were described, followed by a discussion of the tools utilised in collecting the sample. The released sample was shown and non-parametric statistics (categorical) and parametric statistics (demographic) were shown. The results indicated that the quasi-experiment was internally valid by indicating that the two groups in terms of the demographic variables measured were equivalent to one another. Lastly, ethical considerations were addressed.

CHAPTER 4
RESULTS

Introduction

In this chapter the results from an assessment of the reliability of the sub-scales that measured each construct, namely attention conflict and concentration performance, are reported. Descriptive statistics summarising the data are also presented. Furthermore, the results of the inferential statistical analyses are provided. Finally, the themes identified from the qualitative data obtained from the two open-ended question are set out and discussed here.

Assessing unidimensionality

To evaluate the measurement properties of the Mindful Attention Awareness Scale (Carlson & Warren, 2005; Dam et al., 2010) used in measuring attention conflict, the reliability or internal consistency was assessed by means of the SPSS item-analysis procedure and calculating Cronbach alpha coefficients. Given the small sample size (n=15) conducting Factor Analysis (FA) was not believed to be appropriate to assess construct validity.

Internal consistency is indicated by the Cronbach alpha coefficient, which provides the average correlation of the items on the scale (Rouquette & Falissard, 2011). The internal consistency of a scale indicates the degree to which items of a scale measure the same underlining attribute. A Cronbach's alpha coefficient above .7 is considered satisfactory and suggestive of a sufficiently reliable scale (Rouquette & Falissard, 2011). According to Field (2013), items with item-total correlations below a cut-off point of .3, should be removed.

Attention conflict

Concentration performance was measured using the 15 item Mindful Attention Awareness Scale of (Carlson & Warren, 2005; Dam et al., 2010). The Cronbach alpha coefficient was calculated based on the data collected and the scale was considered to be reliable (Cronbach alpha = .951, i.e. >.7; Field 2013). Moreover, as per Field's (2013) recommendation, adequate corrected item-total correlations were also revealed (.97 < r > .39, i.e. all >.3). Following the SPSS item analysis procedure, the

change in the Cronbach alpha coefficient would not improve when removing any of the items.

Based on the assessment of the internal constancy or reliability of the scale, reported above, the Mindful Attention Awareness Scale was deemed to have demonstrated satisfactory measurement properties for further use in the present study and was, therefore, believed to be an appropriate measure of attention conflict, which was used for the purposes of the present study in the further inferential statistical analyses, that is, it proved to be a reliable measure of attention conflict. A composite Mean score for the 15 items of the sub-scale was calculated for each participant.

Descriptive and inferential statistics for each of the variables

In terms of the objectives of the study, namely, to compare the two groups with each other on the selected variables and to find support for the stated hypotheses, descriptive and then inferential statistics were calculated for each of the variables. The results are discussed below.

Descriptive statistics: Cognitive load

The descriptive statistics for the measure of perceived cognitive load, is summarised in Table 7 (see below):

Table 7: Descriptive statistics cognitive load per group

Groups[1]	n	Min	Max	Mean	Std dev[2]
Group 1	7	7	9	7.7	.951
Group 2	5	4	7	6.2	1.169

Notes: [1]Group 1 = mobile communication technology was available; Group 2 = mobile communication technology was not available.

[2]In samples smaller than 25 a standard deviation needs to be interpreted with caution given the limited variability of the data.

From Table 7 (see above) it is evident that Group 1 (i.e., who were allowed to utilise personal technology during the meeting) was found to have both a numerically higher Mean (i.e., experienced a higher cognitive load), and that the range for cognitive load scores were higher and pivoted at 7. It was noted that 7 was the minimum score for Group 1, while it was the maximum score for Group 2. This would suggest that there

was a distinct difference in perceived cognitive load for the two groups and that it was higher for the group in which mobile communication technology was available.

The descriptive statistics for both groups were further graphically represented using a Box-and-Whisker plot., Figure 4. A Box-and-Whisker plot is used to display the distribution of a numerical variable. The plot is interpreted as follows: the solid (bold) line indicates the 50th percentile or mean, while the top and bottom line of each block indicates the 25th and 75th percentile. The whiskers are plotted using Tukey's guideline of the Mean plus minus two standard deviations. Scores that are greater or smaller than the whisker, are considered to be outside the range and are treated as outliers

The Box-and-Whisker plot for the cognitive load variable, is presented in Figure 4 (see below) as is interpreted as suggested above.

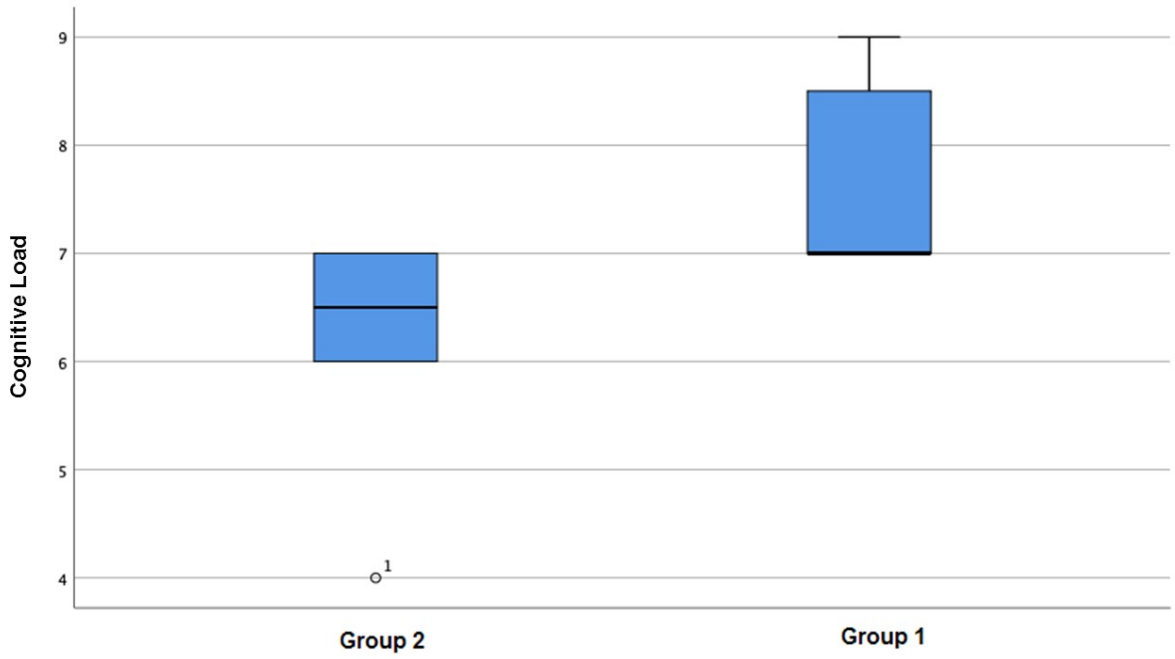


Figure 4: Cognitive load - Box-and-Whisker plot

The minimum perceived cognitive load for Group 1 where mobile communication technology was present is equal to the maximum of Group 2 where mobile communication technology was not present. Group 2 has no whiskers and thus little variation suggesting greater agreement in the group.

Group 1 has only a whisker on the top end, the Mean is at 7 and several respondents are all the way to 8.5 and even to 9. The availability of the mobile communication technology in Group 1 has increased the group's cognitive load in comparison to Group 2 where mobile communication technology was not present.

The error bars showing the 95 per cent confidence interval (CI) for the perceived cognitive load variable, is graphically presented in Figure 5. An error bar indicates the variability of the data and is used to indicate the error or uncertainty in a reported measurement. It gives a general idea of how precise a measurement is, or conversely, how far from the reported value the population value is.

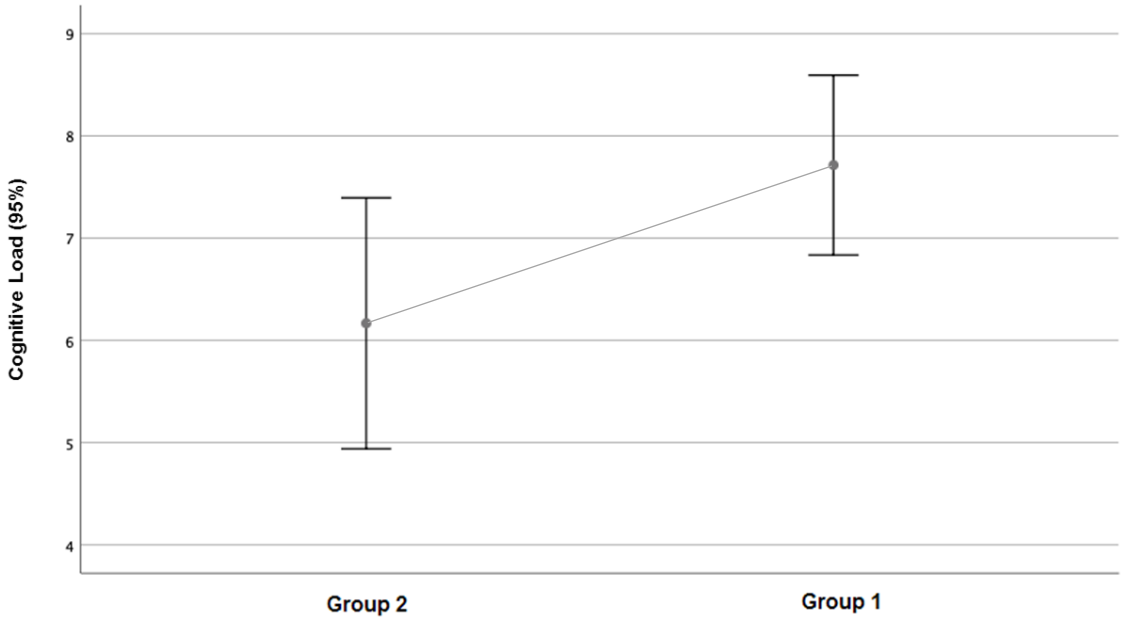


Figure 5: Cognitive load - Error bars showing the 95 per cent Confidence Interval (CI)

As is evident from Figure 5 (above), the 95 per cent CI's for the population Means for the two groups, is distinctly different from each another. From the plot above, it can be seen that the bottom of the CI for the group that had mobile communication technology (Group 1) is almost at the same level as the top end of the CI for the group that did not have mobile communication technology (Group 2).

To further graphically compare the differences in the perceived cognitive load scores for the two groups, Figure 6 shows the frequency of responses on the response scale.

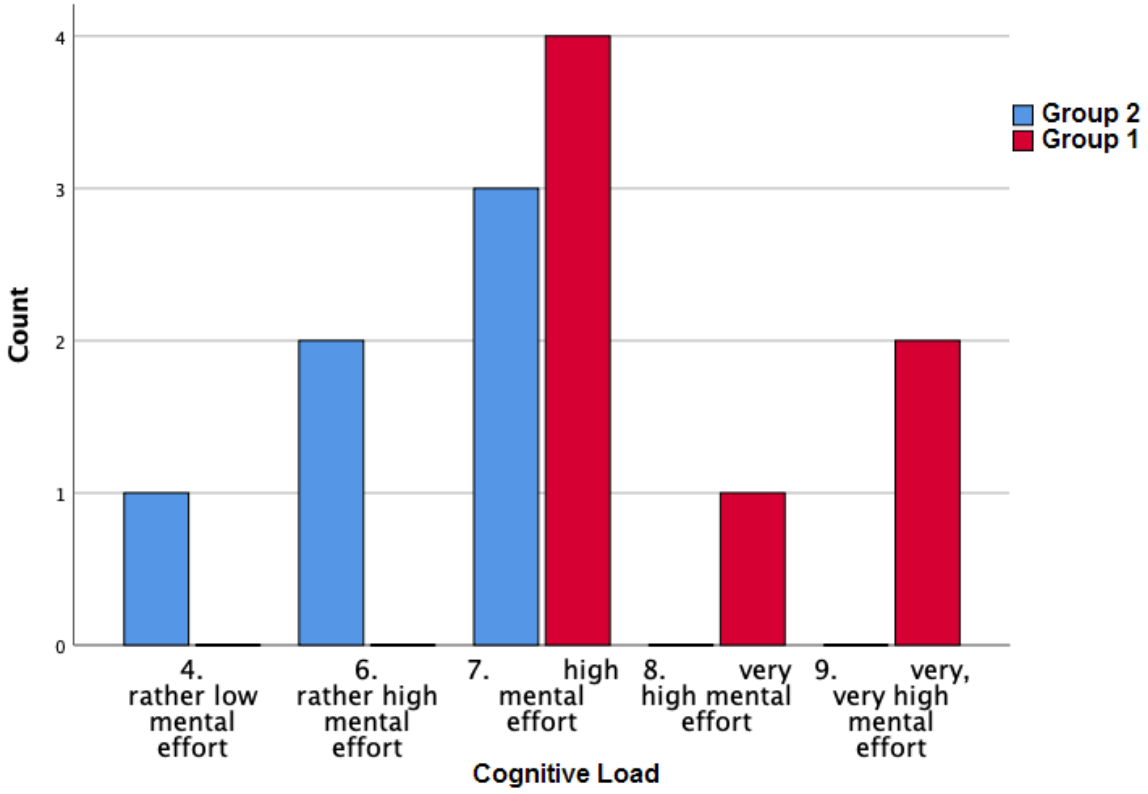


Figure 6: Cognitive load – Response scale

There is a distinct split in the responses. Respondents in Group 1 (with mobile communication technology) chose 7, 8 and 9 on the response scale indicating higher cognitive load, while respondents in Group 2 did not choose any of the same (higher) levels of cognitive load, choosing 4, 6 and 7 as their responses.

Inference statistics: Cognitive load

To assess whether the numerical differences reported between the Means above, are also statically significantly different, a T test analysis was conducted. The result of the T test analysis indicated that the perceived cognitive load Mean scores for the two groups were not only a numerically different, but also statistically significantly different (M_{Gp1}= 7.7; M_{Gp2}= 6.2; t=-2.635; df=11; p=.023, i.e. p<.05).

Summary of cognitive load measures

The results supported the rejection of the null hypothesis, that is, that support was found for the alternative hypotheses that cognitive load would be higher in meetings where digital distraction was present.

Based on the descriptive and inferential statistics reported above, it is evident that perceived cognitive load was distinctly and statistically significantly higher in the group that were allowed to utilise mobile communication technology.

Descriptive statistics: Attention conflict

The descriptive statistics for the measure of perceived attention conflict, is summarised in Table 8 (see below):

Table 8: Descriptive statistics attention conflict

Groups[1]	N	Min	Max	Mean	Std dev[2]
Group 1	7	4.5	5.0	4.9	.182
Group 2	6	4.1	4.8	4.5	.266

Notes: [1]Group 1 = mobile communication technology was available; Group 2 = mobile communication technology was not available.

[2]In samples smaller than 25 a standard deviation needs to be interpreted with caution given the limited variability of the data.

From Table 8 (see above) it is evident that Group 1 (i.e., who were allowed to utilise mobile communication technology during the meeting) was found to have both a higher Mean (i.e., experienced a higher attention conflict), and that the range for attention conflict scores was wider, pivoting at 4.9, compared with Group 2 at 4.5. This would suggest that there was at least a numerical difference in perceived attention conflict for the two groups, with higher attention conflict for the group in which mobile communication technology was available. The same result was graphically represented using a Box-and-Whisker plot.

The statistics for both groups were further graphically represented using a Box-and-Whisker plot. The Box-and-Whisker plot for the attention conflict variable, is presented in Figure 7 (see below).

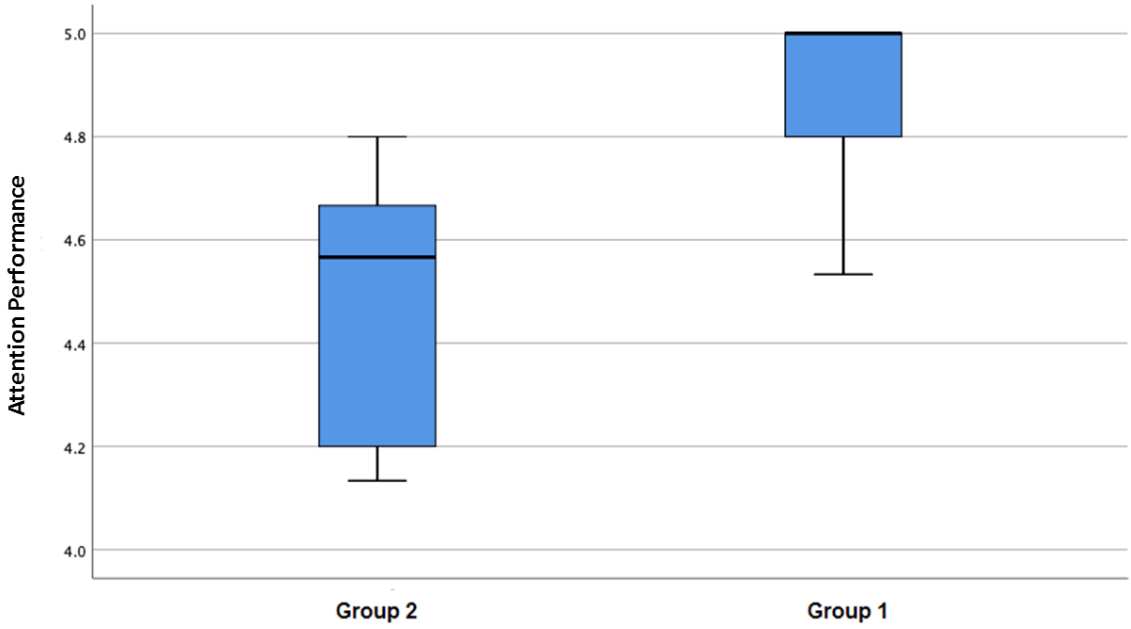


Figure 7: Attention conflict – Box-and-Whisker plot

The minimum perceived attention conflict for Group 1 where mobile communication technology was present is between 4.5 and 5, with the Mean at 5, whereas, Group 2 where mobile communication technology was not present the Mean is 4.58, representing that perceived attention conflict for Group 1 is much higher than that for Group 2. Group 1 has little whiskers thus less variation than Group 2 with both upper and lower whiskers suggesting greater agreement in Group 1 on perceived attention conflict where mobile communication technology was present.

The error bars showing the 95 per cent CI for the perceived attention conflict variable, are graphically presented in Figure 8.

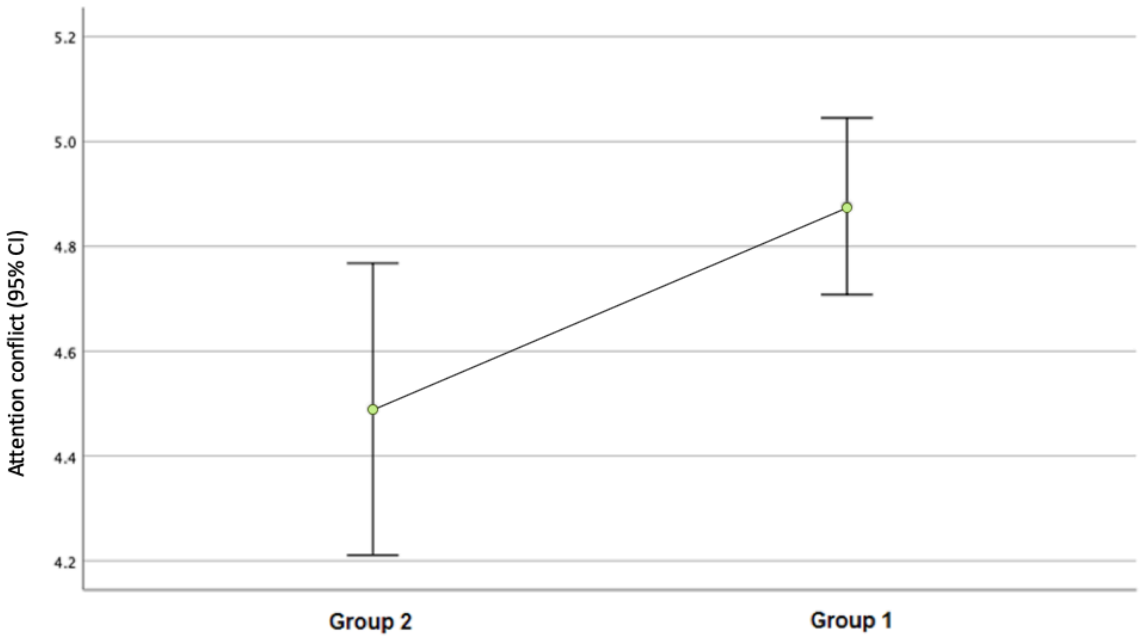


Figure 8: Attention conflict - Error bars showing the 95 per cent Confidence Interval (CI)

As is evident from Figure 8 (above), the 95 per cent CI's for the population Means for the two groups is distinctly different from each another. From the plot above, it can be seen that similar to cognitive load, attention conflicts at the bottom of the CI for the group that had mobile communication technology (Group 1) is almost at the same level as the top end of the CI for the group that did not have mobile communication technology (Group 2). There is also a wider distribution range in Group 2, whereas that of Group 1's is smaller, indicating that the perceived attention conflict is more constant in Group 1.

To further assess the difference in the perceived attention conflict variable for the two groups, Figure 9 shows the frequency of responses on the response scale.

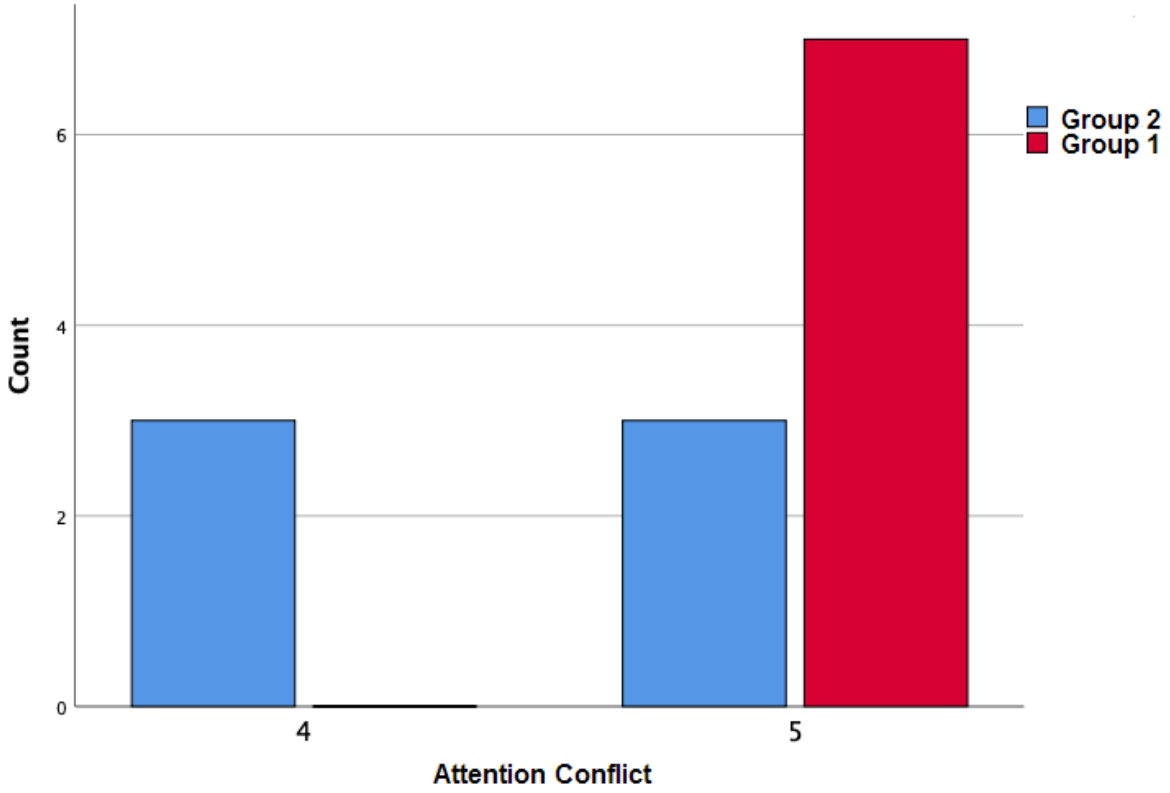


Figure 9: Attention conflict: Response scale

All the respondents in Group 1 (with mobile communication technology) chose 5 on the response scale indicating higher attention conflict, while respondents in Group 2 choose less, only 50 per cent of the same (higher) levels of cognitive load, choosing 4 and 5 as their responses.

Inference statistics: Attention conflict

To assess whether the numerical differences reported between the Means above, are also statically significantly different a T-test analysis was conducted. The result of the T-test analysis indicated that the perceived attention conflict Mean scores for the two groups were not only a numerically different, but also statistically significantly different (M_{Gp1}= 4.9; M_{Gp2}= 4.5; t=-3.108; df=11; p=.010, i.e. p<.05).

Summary of differences in attention conflict measures

The results supported the rejection of the null hypotheses, that is, that support was found for the alternative hypotheses that attention conflict would be higher in meetings where digital distraction was present.

From the descriptive and inferential statistics reported above, it is evident that perceived attention conflict was distinctly and statistically significantly higher in the group who were allowed to utilise mobile communication technology.

Meeting performance

Meeting performance was assed using three measurements, namely 1) time to make a decision, 2) number of decisions made, and 3) the quality of the decisions that were made.

Time to make a decision

The time it took to make each decision, was captured and is summarised for each group in Table 9 (see below).

Table 9: Descriptive statistics for the time it took to make a decision (in minutes)

Groups[1]	Ops Ready	Contract Mgmt.	HRD Acc	SLP	HR System	Job Grade	Medical Review	Total
Group 1	9.12	21.93	10.02	7.35	9.98	15.37	10.95	84.72
Group 2	9.18	10.53	3.98	14.42	8.42	8.42	3.95	60.88
Difference	**-0.06**	**11.4**	**6.04**	**-7.07**	**1.56**	**6.95**	**7**	**23.84**

Note: [1]Group 1 = mobile communication technology was available; Group 2 = mobile communication technology was not available.

Legend: Ops Ready = Labour Operational Readiness Plan; Contract Mgmt. = Contractor Management; HRD Acc = Human Resources Development Accreditation; SLP = Final Social Labour Plan Execution and 2020-24 Social Labour planning; HR System = Human Resources system (Sage™ X3) implementation; Job Grade = Job Grading and Salary Matching – Task Team; Medical Review= Medical Review of AB level employees – Task Team

The difference in the total time it took to make all the decisions required by the agenda of the meetings between the two groups, expressed in minutes and indicated decimally, were distinctly different. Group 1 (i.e. with mobile communication technology) took almost 30 per cent longer to make the same decisions as Group 2 (85 versus 61 minutes, respectively).

Number of decisions made

Group 1 developed 13 distinct options and made eight decisions, compared to Group 2's 11 distinct options and making seven decisions, following the same agenda discussing the same points. Group 1 with mobile communication technology developed 2 more options and made one more decision. This difference between the

options and decisions of each groups is relatively small and seems not be distinctly different between the groups.

Quality of decisions

To assess the quality of the decisions made in the respective meetings, the meetings were recorded and two SMEe evaluated each decision using a set of questions adapted from the Patient Education and Counselling more specifically, the 9-item Shared Decision-Making Questionnaire by Kriston Levente, et al. (2010). The average quality rating for each decision and, the average score of the seven decisions, per group, are summarised in Table 10 (see below).

Table 10: Descriptive statistics of the quality of decisions average for two evaluators

Groups[1]	Ops Ready	Contract Mgmt.	HRD Acc	SLP	HR System	Job Grade	Medical Review	Average Quality of Dec
Group 1	3.1	3	2.9	3.4	2.7	3.4	3.7	3.2
Group 2	2.8	3.2	3.0	3.4	3.2	3.3	2.8	3.1
Difference	0.2	-0.2	-0.1	0.0	-0.4	0.1	0.9	0.1

Note: [1]Group 1 = mobile communication technology was available; Group 2 = mobile communication technology was not available.

Legend: Ops Ready = Labour Operational Readiness Plan; Contract Mgmt. = Contractor Management; HRD Acc = Human Resources Development Accreditation; SLP = Final Social Labour Plan Execution and 2020-24 Social Labour planning; HR System = Human Resources system (Sage™ X3) implementation; Job Grade = Job Grading and Salary Matching – Task Team; Medical Review= Medical Review of AB level employees – Task Team

The quality of the decisions made, were evaluated by SMEs on a 5-point response scale, 1 low and 5 high and summarised in Table 10 (see above). The difference between the two groups' quality was not distinctly different. The largest difference on an individual area was .9 and on the overall average .1.

Qualitative data

The data obtained from the two open-ended questions were analysed, and themes were identified from the responses.

Open ended questions

In the present study two open ended questions was asked of the respondents after the respective meetings; 1) Do you believe that employees should be able to access

digital devices (e.g. cell phones and laptops) during meetings?; and 2) Why do you believe employees should or should one not be able to access their digital devices or not?

In response to the first question: 'Do you believe that employees should be able to access digital devices (e.g., cell phones and laptops) during meetings?' 11 out of 15 respondents (this equates to 67 per cent) indicated that they believed that mobile communication technology must be available and accessible in meetings, and the rest (33 per cent) stated that it must not be allowed.

The respondents in Group 1 were split, with 50 per cent who wanted mobile communication technology in meetings and 50 per cent that did not want it. The respondents in Group 2 collectively agreed that they wanted mobile communication technology in their meetings

As seen above, the respondents generally agreed that personal mobile communication technology must be accessible in meetings. The general themes that could be inferred from the responses are that mobile communication technology assisted meeting participants with making their meetings more productive. Meeting participants can make 'in time' quick Web references regarding the content of the meeting and even do calculations in, for example, Microsoft Excel, when required from the meeting discussion or content. Respondents also felt that mobile communication technology ensured that participants were reachable in case of emergencies or any other urgent operational requirement. Respondents also believed that meeting participants could capture information (in the form off minutes or notes) immediately while the information was still fresh in the participants' minds, and for easy reference and sharing when so required, as it was captured digitally.

The respondents who wanted their mobile communication technology in meetings had the following supporting answers to why it should be the case: 'Employees should access their digital devices in meetings in order to make quick reference and calculations. And still be reachable in case of emergencies', 'I believe employees should have access to digital devises [*sic*] to stay alert and be reachable in case of emergencies', 'Yes, for work related purposes to use for the meetings they are

engaging in', 'It will help them to capture the notes or minutes fast', 'Yes, Digital devices should be accessed during meetings in order to capture information fresh as it is and be easily accessed when needed', 'They must be able to access the device in terms of emergency at their homes'.

In contrast to the response above, a third of the respondents answered the questions negatively. They suggested that the devices distracted their attention and that the use of available digital communication technology encumbered their concentration, making them unproductive meeting participants. The effect of being distracted and losing attention, according to these respondents, led to meeting participants not being able to grasp and remember the content of the meetings they attended.

The respondents that believed mobile communication technology should not be allowed supported their views with the following supporting answers: 'In my opinion digital devices must not be accessible to employees during meetings because it will distract them from the meeting, at the end lose focus and concentration and therefore not be able to know and understand the importance and relevance of the meeting they have attended', 'NO, it distracts me', 'No because the device distract the attention', 'No because they will lose concentration', and 'I will never listen if I have a mobile device distracting me'.

From the open-ended questions' discussion above, it can be deducted that two thirds of the respondents would prefer to have their digital communication technology available and also be allowed to use it in meetings. Their responses suggest that they are mitigating the digital distraction with the practical advantage gained by having digital communication technology in meetings.

Summary of statistical results

To summarise the results of the various statistical analyses discussed above, it was found that:

- based on the demographic variables that were collected, statistically significant differences were not found between the two groups;
- concentration performance or average level of distractibility of the individuals in each of the two groups was found to be statistically significantly higher in the

group where mobile communication technology was available and could be used;

- cognitive load was found to be statistically significantly higher in the group where mobile communication technology was available and could be used;
- attention conflict was found to be statistically significantly higher in the group where mobile communication technology was available and could be used; and
- the number of decisions and the quality of the decisions, as rated by two independent SMEs, were found to be similar. However, the group where mobile communication technology was available took 120 minutes to achieve a similar outcome to that achieved by the group where mobile communication technology was not available (90 minutes), that is, it took 30 per cent longer when mobile communication technology was available.

Conclusion

In this chapter, the assessment of reliability or internal consistency of the measurement scales, descriptive statistics and results of the statistical analyses were reported. Unidimentionality was assessed for two constructs, namely,)1 attention conflict and 2) concentration performance. Descriptive statistics of each construct per group was shared, and group differences noted. Furthermore, inference statistics were shared and discussed. Lastly, qualitative data obtained from two open-ended questions and average meeting attendance were assessed. It was found that all the hypotheses were supported by the study.

CHAPTER 5
DISCUSSION

Introduction

In this chapter, the findings of the present study are discussed in line with the literature evaluated and the results obtained from the statistical analyses. A discussion of the main findings from the research and, where applicable, links the literature to the research outcomes. The limitations of the present study are identified and discussed, identifying the potential influence these limitations may have on the present study and its conclusions, as well as recommendations for further studies, building on the current exploratory study. Potential contributions, both to the theory and the practice, are suggested for additional studies to be undertaken that further inform digital distraction, building on the current exploratory study.

Meetings are important as they facilitate communication and collaboration processes that are essential to solve all types and levels of problems or issues within organisations. However, for meetings to be a success, engagement and effective participation of attendees are necessary factors in meeting performance. However, with employees increasingly using mobile devices while in meetings, digital distractions may lead to cognitive (over-)load, attention conflict and a resulting loss of concentration and/or attentiveness.

Given the constraints of human cognitive processes, digital distractions (additional stimuli) in meetings may lead to members shifting their attention from the meeting to the technology, resulting in a situation where they are no longer fully engaged in the discussions being held and so not able to contribute effectively to decision-making. Such a situation may result in poorer quality decisions being made and/or that decisions take unnecessarily long to be made.

The present study found that perceived cognitive load was distinctly higher in meetings where digital distraction (allowed to utilise mobile communication technology) was present and thus support the notion discussed above and the present study that perceived cognitive load would be statistically significantly higher in a meeting where mobile communication technology is present, compared with a meeting where it is not present. This is in support of what Puglisi et al. & Sweller (2018; 1988) has postulated

that high cognitive load typically results in ineffective participation; and that learners confronted with higher levels of cognitive load, recalled significantly less content than those with lower levels of cognitive. Also agrees with Ward, Duke, Gneezy and Bos (2017) & Engle and Kane (2003) as well as Koch, Poljac, Müller, & Kiesel (2018) views that multiple distractions places pressure on available attentional capacity creating attention conflict and increases cognitive load. In the modern work environment employees switch between several demanding and ongoing tasks, this switching within the available cognitive capacity, increase cognitive load as per the brain is continuously challenged to assign attention to each stimulus received, ultimately neglecting the primary task at hand.

As suggested above, limited cognitive capacity to process information forces individuals to become more selective in their allocation of attention, which in turn creates attention conflict as the brain tries to focus on the one task and still trying to deal with the others as per (Groff et al., 1983; Lawrence et al., 2017). The present study based on the descriptive and inferential statistics reported in Chapter 4 above, supports the notion that perceived attention conflict was distinctly and statistically significantly higher in the group that were allowed to utilise mobile communication technology (thus additional stimuli introduced) in the measured meetings.

Meeting Performance

Meeting productivity (including time to make decisions, decision quality and number of decisions made) was lower in the meeting where mobile communication technology was present, compared to the meeting where it was not present.

Further to this, it was suggested that meeting productivity and effectiveness, i.e. the quantity and quality of decision-making would be lower with the presence of mobile communication technology (Fetzer, 2009; Geimer et al., 2015). In the present study the difference between the two groups of the total time it took to make the decisions using the same agenda were markedly different. The members of the two meetings made a similar number of decisions, which the independent assessors rated as being of similar quality, however, the group in which mobile communication technology was available took 30 per cent longer (120 vs 90 mins) to come to a similar outcome.

An interesting finding, possibly attributed to team coherence, was with the assessment of the quality of the decisions between the groups. The two Subject Matter Experts' evaluations were not particularly different and does not support the notion that meeting productivity and specifically decision quality may potentially be lower in a meeting where mobile communication technology is present, compared to a meeting where it is not present. It is postulated that because the concentration performance of the two groups were similar it acted as a moderator making the two groups equally distractible, neutralising the effect the digital distraction had on the quality of the decisions made.

The respondents in the present study as part of the findings on the open-ended questions, preferer the presence of mobile communication technology in meetings. Their decisions focussing on the practicality of it and not the distractibility it brings. They believe that the distraction it brings is outweighed by the advantages the mobile communication technology poses in management. Recording of the meetings, looking for solutions online and being available to the outside world is important.

Based on the finding, longer time to make decisions when mobile communication technology is present, the present study supports the proposition that digital distraction places additional demand on the cognitive processes required to fulfil cognitive decision-making tasks, which required to conduct a productive meeting (i.e. making good decisions in the shortest possible time) and that if mobile communication technology is allowed meeting performance may be vulnerable.

Limitations and recommendations for future studies

Several limitations were identified in the study. The limitations are not uncommon in studies of this nature and were mitigated for as far as possible. It is recommended that future studies address these limitations and so further contribute to this field of study.

The first limitation that restricted further statistical inference was the small sample (n=15), with Group 1 (n=7) and Group 2 (n=8). A larger sample and possible multiple meetings over time (not *ex post faco*) will allow further statistics to be inferred.

Mono-method bias refers to observations, not to programs or causes. The concern is a conception of method variance as being produced by the nature of the method itself,

and therefore, variables assessed with the same method would share common-method variance that potentially inflates observed correlations (Spector, Rosen, Richardson, Williams, & Johnson, 2019). Mono-method bias was a limitation in the present study as the same method was utilised with potential observed inflation, it is thus recommended for future studies with similar topic that more measures using more approaches would be to utilise to improve and counter mono-method bias.

The study was also limited by only measuring three constructs under cognitive processing. There are potentially several other relationships that may be explored. The differences between constructs and well as the relationships between these constructs. To disentangle the impact that digital distraction has on performance, on meetings performance and performance in general. It is, therefore, recommended that future studies be undertaken that measurement more cognitive processes, i.e. more constructs than attention conflict and cognitive load. Potential results may assist, academics and practitioners, to improve understanding of the constructs of attention in contrast to distraction and the influence that mobile communication technology has on operational processes and in turn the possible influence it may or may not have on company's bottom line. Likewise, to assist companies with theoretical backing in making challenging future decisions in a world that is rapidly digitally immersed.

The outcome where the quality of the decisions between the groups were found not to be distinctly different partly refuting the claim that quality may be compromised in the case where digital distraction is present in meetings; may be further studied. Specifically, the moderation relationship of similar (or dissimilar) group concentration performance has on the effect digital and other distraction has on the quality of meeting decisions.

Cross sectional data has limitations as it only refers to a test at a specific time and is not tested over time. It is recommended to improve on the limitation on cross sectional data to in the future do the same study over time, thus improve the data longitudinally.

As stated, meetings are common and take place frequently, what would the possible long-term effect of being digitally distracted day in and day out, operating under sustained higher levels of cognitive load and attention conflict, be? There is a

probability that this constant higher levels of cognitive load and attention conflict may lead to increased stress and even possible burnout. Future longitudinal studies can investigate the possible links that digital distraction has on the constructs of stress and burnout and their effects on performance.

The present study investigated an integrated theoretical/conceptual model and it is recommended that the model be further developed to include the constructs not evaluated in the present study, especially the addition of other constructs of cognitive processing to evaluate their influences on meeting and even general performance. Concentration performance of individuals or individuals as part of a group may moderate or aggravate the cognitive processing constructs.

Contribution of the study

The study led to a better understanding of the effect of digital distractions and performance. The theoretical, methodological and practical contributions are discussed below.

Theoretical contribution

Few studies could be found that have investigated whether the presence of digital distraction would negatively affect specifically meeting performance. Particularly, no studies that used a quasi-experimental approach allowing for causal inferences. The current absence of empirical evidence to support either viewpoint, therefore, created an opportunity for the present study to address a gap in the current literature.

A conceptional model (Figure 10) was suggested to be further developed and tested.

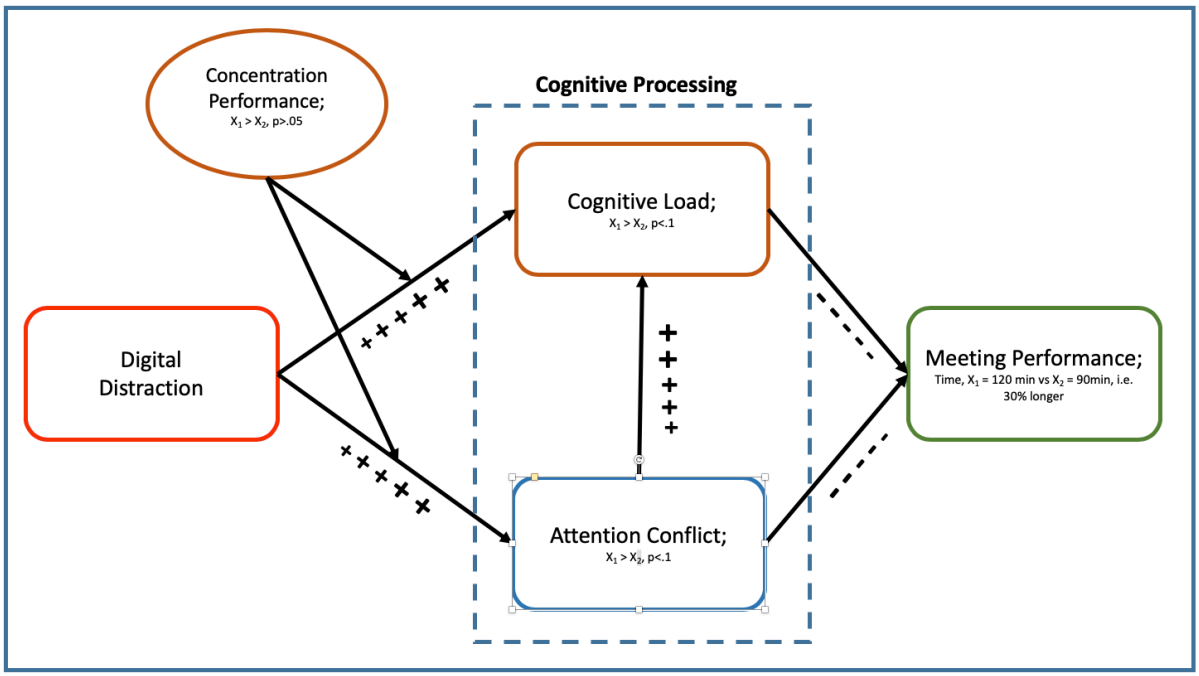


Figure 10: Proposed theoretical/conceptual model (updated)

Methodological contribution

There are generally few experimental studies in human resources/people management research. Using an experiment in HR studies is somewhat novel and provides the opportunity to causal inferences, something which is seldom the case in HR research. This study is an example of how experiments can be done in HR research. Typically, HR research makes use of correlational studies where only the covariance or relationship can be estimated. Whereas, experiments allow for causal relationships to be investigated which is not possible in correlational studies. Here is one example of how to do it and hopefully more experimental studies will follow suite.

Practical contribution

It was already established that meetings are essential to effective organisational management, and that it is resource intensive (Bagire, Byarugaba, & Kyogabiirwe, 2015) with managers spending high amounts of their potential work time in meetings. Companies experience a high volume of tedious meetings wasting resources. In the current resource restrained environments companies need to be resource efficient without compromising on the desired outcomes i.e. the quantity and quality of decision made.

The present study's finding is that there is a definite difference (higher) in perceived attention conflict where mobile communication technology was allowed in the meeting, in contrast to where no mobile communication technology was present. The present study also found that this increased attention conflict lead to and increase cognitive load in the group in which mobile communication technology was available.

So at a great scale it is probably not a good idea to have mobile communication technology in meetings not only does it over time pose a potential threat to general employee health (as postulated above) but also increase time spent in meetings decreasing the time available to spend on primary tasks. A potential productivity gain, by just excluding mobile communication technology, of 33 per cent on every meeting is substantial and need to be exploited by companies.

Managerial Implications

Based on the findings of the present study, it is recommended that, unless mobile communication technology is required, managers declare specific meetings, where a high level of meeting performance is required, tech-free zones. The findings may be further addressed in company policies, practice and procedure manuals and also in managerial induction and development programmes/interventions, (Elliott-Dorans, 2018).

This suggests, for example, the development of institutional policies and procurement practices that are less focused on harnessing the 'potential' of emerging technologies and tools, and more concerned with improving uses of mainstream established technologies. This would see the development of digital management that 'fit' with wider structures of meeting management assessment and the constraints of the meeting frequency.

Conclusion

From the findings the argument, that digital distractions in meetings (additional stimuli) burdens human cognitive processes i.e. attention conflict and cognitive load that then leads to members shifting their attention from the meeting to the mobile communication technology, resulting in lack of engagement and ultimately resulting in poorer quality decisions being made and/or that decisions take unnecessarily long to

be made. The current study supports the claim that the presence of digital distraction negatively affects meeting performance.

All told, there is plenty of scope, as the meeting participants in our study remind us, for company authorities and leadership to more readily recognise and work with the realities of digital technology use and the user (participant) experience.

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APPENDICES

Appendix A: Meeting Agenda

MEETING AGENDA

Human Capital Operational Planning Sessions (2019-20)

What?	What?	Who?	By When?
Main Objectives 2019-20			
Operational Readiness Plan Execution			
Contractor Management			
HRD Accreditation			
Final SLP Execution and SLP 2020-24			
HR Systems - Implementation X3			
Job Grading and Salary Matching - 90 Days			
Medical Review AB and C – Task Team			

Appendix B: Qualtrics Questionnaire

Introduction

Dear Respondent

I am currently studying towards my Masters' Degree in People Management at the University of Cape Town. You are invited to participate in a research study under the supervision of Professor Anton Schlechter. The focus of the research study is to investigate the relationship between digital distractions and the effectiveness of meetings.

The survey should take approximately 10 minutes to complete and your responses will remain anonymous.

Your participation in this research is voluntary and you are not required to disclose your name anywhere on the questionnaire. All responses will be treated confidentially and will only be used for the purposes of this research.

If you have any questions regarding the research, please contact the researcher Jacques Malan at mlnjac013@myuct.co.za or the supervisor Prof Anton Schlechter at anton.schlechter@uct.ac.za.

Thank you in advance for your participation and cooperation.

Differentiation

Where are your normal place of work, Mine Site or Industrial Office?

- ○ Mine Site
- ○ Industrial Office

Cognitive Load

Consider the meeting that was just held. In solving the problems discussed, I invested...

Choose one option of the nine below.

- ○ 1. very, very low mental effort
- ○ 2. very low mental effort
- ○ 3. low mental effort
- ○ 4. rather low mental effort
- ○ 5. neither low nor high mental effort
- ○ 6. rather high mental effort
- ○ 7. high mental effort
- ○ 8. very high mental effort
- ○ 9. very, very high mental effort

Performance

Consider the meeting that was just held. Rank, in order of importance by dragging the options up or down, your perception of the type of decisions that were made?

- Creating Options
- Finding Relevant Information
- Predicting Consequences
- Weighing Options

Distraction

The following questions are meant to assess your attention and performance during the meeting that was just held.

Please indicate on a scale from 1 to 5, where 1= Not at all and 5= Great deal, how often the following happened:

	A great deal	A lot	A moderate amount	A little	None at all
1. I did things I had not intended to					
2. Distractions disturbed my focus					
3. Made mistakes/errors in judgement					
4. Concentrated for short periods of time					
5. Could not express what I wanted to (tip of tongue)					
6. Had difficulty to follow conversations					
7. Daydreamed instead of listening/engaging					
8. Became Impatient					
9. Acted differently than planned					
10. Had difficulty to follow the conversation					
11. Spoke quickly					
12. Read repeatedly					
13. Wonder whether I had used a word correctly					
14. Mind wandered					
15. I found it difficult to stay focused on what's happening in the present					

Open

Do you believe that employees should be able to access digital devices (e.g. cellphones and laptops) during meetings? Why do you believe employees should or should one not be able to access their digital devices or not?

Do you believe that meetings are less productive and/or that lower quality decisions are made when employees are able to access digital devices (e.g. cellphones and laptops) during meetings? Alternatively, do you believe that this is not the case?

Please indicate if you agree with one or both assertions that 1) less productive and/or that 2) lower quality decisions are made and why you say so.

How many meetings, on average, do you attend per a week?

What is the average length of meetings you attend?

Age at your next birthday

Your highest level of education

- High school graduate, diploma or the equivalent
- Trade/technical/vocational training
- Bachelor's degree or equivalent
- Honours degree or equivalent
- Master's degree
- Doctorate

Please specify your job level

- Non-managerial/non-supervisory
- Supervisor/Team Leader
- Middle Management
- Senior Management/Executive
- Specialist (non-managerial)

How long have you worked in this organisation (in years)?

How long have you worked or been economically active (in years)?

Appendix C: University of Cape Town Commerce Faculty Ethics in Research Committee (EiRC)

Project title:: The influence of Digital Distraction on meeting productivity

Author: Jacob Malan
Reviewer: Signe Rousseau
Submitted: 4/10/2019
Review Completed?: True
Reviewer Score: 3
Overall Submission Score: 3

SUBMISSION:
Cover letter providing a summary of the research project
A copy of the research proposal
Questionnaire to be used in the research (if needed)
Consent form (where needed)
Motivation for an expedited review (where needed)
Application signed by relevant authorities (e.g. supervisor)

SUPERVISOR SIGNATURE:
Yes

Is the application complete?:
Yes

Comments on the Submission:
The application is complete (cover letter, questionnaire and consent form on one document, but all provided).

Explanation Ethics Issues:
Adequately covered in the proposal

Comments on Explanation of Ethics Issues:
Ethical considerations adequately covered and explained in the proposal (survey participants will remain anonymous, and debriefing offered following the study if required).

Risk:
Low risk data unlikely to cause harm

Comment on Risk:
Risk possibility recorded as low/negligible.

Data Security:
Data stored insecurely or not disposed of after use

Comments on the use of data:
The cover letter to the survey specifies that the findings of the study may be communicated academically (publications, conferences etc), and that anonymity will maintained); however no mention of how/where the data will be stored during and after the study (see below for further comment on data storage and management).

Consent:
Consent required and obtainable

Comments Informed Consent:
Consent form supplied.

Consent Organisation:
Consent required and obtainable

International Research:
No

Further Comments:
The application is generally in order for ethics approval, but please note that while not a requirement, researchers are encouraged to store data on an open-access platform, with appropriate measures taken for protection of personal information (see https://www.uct.ac.za/sites/default/files/image_tool/images/328/about/policies/TGO_Policy_Research_Data_Management_2018.pdf)

RECOMMENDATION:
Approved
(Score: 3)

Appendix D: Company Approval Letter

[redacted] [redacted]

21 November 2018

To whom it may concern

I, the undersigned, hereby confirm that:

Mr Jacob Jacobus Malan student no. MLNJAC013 is registered for MPhil People Management and specifically BUS5006W. He is hereby authorised to conduct a social experiment and collect data to be utilised for research only. The Company has no ethical prejudice towards the utilisation of the data.

I do hope that you find the afore-mentioned in order.

Yours sincerely

Keneiloe Mohafa

[redacted]